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Soil Survey

of

Steuben County, New York

By

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Bureau of Chemistry and Soils

In cooperation with the
Cornell University Agricultural Experiment Station

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By C. S. PEARSON, in Charge, F. B. HOWE, and D. F. KINSMAN, Cornell University Agricultural Experiment Station, and ROBERT WILDERMUTH, R. C. ROBERTS, and A. H. HASTY, United States Department of Agriculture

INTRODUCTION

Steuben County is situated in a region of well-distributed and moderate rainfall. The mean annual temperature of 47.7° F. is typical of that for southwestern New York, which in general is characterized by long, moderately cold winters and short, cool summers. Climatic conditions have favored the development of a system of general farming based on dairying and potato production. The tempering effect of Keuka Lake on the climate of the adjacent slopes has resulted in the development of viticulture as the dominant industry of this particular section.

The county is in a dissected plateau region underlain by alternate beds of shale and sandstones, entirely covered with a mantle of glacial drift of variable thickness. The glacial material in the upland region is composed mainly of material formed by decomposition of the local underlying rocks, whereas the material in the valleys, deposited through the action of water, contains much limestone and other rock material brought in from regions to the north.

The county lies in the region known as the gray-brown podzolic soil region of northeastern United States and was, before being brought under cultivation, covered with forests of white pine and hardwoods, the latter consisting principally of maple, beech, birch, oak, hickory, and ash.

On the basis of their topographic position, the soils of Steuben County may be broadly separated into two groups—upland soils and valley soils. They are further classified, according to degree of drainage, reaction of subsoil material, and depth of soil mantle.

As regards total acreage, the soils of the upland group are the most important, as they occupy 76 percent of the land area. Because of their widespread distribution, the cropping characteristics of these soils have determined the trend of agriculture in the county.

The well-drained upland soils, which include the members of the Lordstown, Bath, Angola, and Cattaraugus series, are dominant in the northwest and southwest parts of the county. It is in these sections that potato production has reached its highest development, because the soils are particularly well adapted to this crop. Not only are better yields of potatoes obtained on these soils but small grains, silage corn, and hay crops give greater returns than elsewhere in the county.

The imperfectly drained and poorly drained upland soils are distributed over the entire county with the exception of the northwest corner. Dairying has developed as the major industry on these soils,

because their physical characteristics limit the crops that can be grown with any degree of success to small grains, grasses for pasture, and such hay crops as timothy and clover.

The imperfectly drained upland soils are described in this report as members of the Mardin, Langford, and Hornell series; the poorly drained as members of the Fremont, Volusia, Erie, and Allis series. Permanently wet soils are included in the Chippewa and Norwich series. Many of the abandoned farms in the upland section are located on the poorly drained soils. The soils of this group are distinctly inferior in productive capacity to the imperfectly drained soils.

The valley soils, although representing only 24 percent of the total area of the county, are nevertheless highly important agricultural soils. They are subdivided into several groups, based on the character of the material, its age, and the degree of drainage. The reaction of the subsoil material is also used as a basis for subdivision.

The system of agriculture followed on the valley soils is one of general farming, with dairying as the major industry. The soils are well adapted to all the crops common to the county. Higher yields of small grains, silage corn, and hay are obtained on the valley soils than on the upland soils. At present alfalfa is grown only on soils occurring in the valleys. The alkaline, well-drained, friable, and gravelly subsoil characteristics of many of the valley soils are favorable to this crop. Besides forage crops necessary for dairy cattle, dry beans, canning peas, and potatoes are important crops grown on the valley soils.

Well-drained valley soils are described in this report as members of the Wooster, Lansing, Chenango, Howard, Arkport, Dunkirk, Groton, and Otisville series; the well-drained alluvial soils as members of the Chagrin and Tioga series; the imperfectly drained valley soils as members of the Caneadea, Middlebury, and Eel series; and the poorly drained as members of the Wayland and Holly series.

A high percentage of the total acreage of the valley soils is under cultivation. Certain areas, however, because of their rough surface relief or water-soaked condition, are utilized only as pasture. The soils with rough surface relief, representing morainic deposits, are included in the Groton and Otisville series. The excessively wet soils, consisting mainly of swamps, are included in the Holly and Wayland series.

The reclaimed areas of muck are used exclusively for the production of vegetables. The largest and most important areas are north of Hornell along the county line. The mucks are alkaline and in many places are underlain by beds of marl.

COUNTY SURVEYED

Steuben County is situated in the south-central part of western New York, the Pennsylvania-New York State line forming the southern boundary (fig. 1). It is rectangular in shape, extending 40 miles north and south and 35 miles east and west, with a land area of 1,398 square miles, or 894,720 acres.

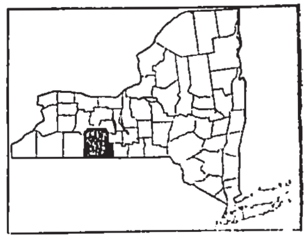

FIGURE 1.—Sketch map showing location of Steuben County, N.Y.

It lies entirely within the southwestern plateau section of the State, a part of the Allegheny Plateau. The elevation ranges from nearly 2,500 feet above sea level in the southwestern corner, in the town of Troupsburg, to 710 feet at Hammondsport at the head of Keuka Lake. The watershed between Lake Ontario and Susquehanna River extends across the northern part of the county. The relief is that of a plateau, somewhat incompletely dissected by a small number of deep narrow valleys separated by strongly rolling uplands. The higher points in the uplands have nearly uniform elevations with a slight inclination to the north. The principal dissecting valleys are those of Canisteo and Cohocton Rivers, the bordering slopes of which are generally steep, rising from 300 to 800 feet within a distance of 1 or 2 miles.

Tioga River rises in Pennsylvania, unites with Canisteo River at Erwins and with Cohocton River at Painted Post. From Painted Post to its mouth it is known as Chemung River. With the exception of a few small streams in the northwestern and northeastern corners, which are in the Lake Ontario drainage basin, the entire county is drained by this system of rivers which are tributary to Susquehanna River.

The most important of the main valleys are those of Cohocton and Canisteo Rivers. These traverse the county in a southeasterly direction, heading in the northwestern part and uniting at Painted Post to form the Chemung River Valley. Canisteo River Valley to the village of Canisteo is about 1 mile wide and from there to Addison is in few places more than one half mile wide, and the valley slopes are steep. The Cohocton River Valley is wider, ranging from 1 to 2 miles in width from its source, north of the village of Cohocton, to its junction with the Chemung Valley. Wide level terraces of water-deposited material occur throughout its entire length. The deep valley occupied by Keuka Lake extends 17 miles southwest from the county line near Branchport, Ontario County, connecting at Bath with the Cohocton Valley. From Hammondsport to Bath the valley is filled with deep deposits of glacial drift, and much of the land has an irregular surface relief. The preglacial drainage from Keuka Lake, or rather from the valley which the lake now occupies, was to the south, but during the retreat of the ice the valley was choked with drift, causing the waters to seek a northern outlet. The valley of Canandaigua Lake extends southwestward from the head of the lake in Ontario County to Naples and thence westward to Wayland

in Steuben County and to Dansville just west of the county line in Livingston County. As in the case of Keuka Lake, the preglacial drainage of this valley was to the south, but, owing to choking of the valley with deep deposits of drift, the waters of the lake now flow northward.

Most of the glacial-drift material of the two valleys consists of unconsolidated deposits of stratified sand and gravel. An area of similar material is the valley of Mud Creek, extending southwestward from the village of Bradford to Savona and connecting at the latter place with the Cohocton Valley. These deposits represent a morainic condition and occur in all the larger valleys in the northern part of the county. During the retreat of the glacier, water flowing from the ice front was impounded, forming temporary lakes, and the materials settling in these still waters are characterized by gravel-free fine-textured silts and clays. Small areas of such lacustrine deposits occur southwest of Wayland along the county line.

Most of the slopes bordering all the larger valleys are steep immediately above the valley floor, rising from 600 to 800 feet within a distance of 1 mile, and from this point back to areas of maximum elevation the slope is more gradual. This is especially true of the northward slopes which are distinctly shorter and steeper than the southern ones.

The elevation of the upland section of the county is fairly uniform, the greatest altitudes occurring in the southwestern corner of the county. The surface relief ranges from undulating to strongly rolling.

Prior to the arrival of white men this part of the State was occupied by the Seneca Indians. The gathering of the Indians and Tories for the invasion of Wyoming Valley took place within this county, as a result of which General Sullivan proceeded to the Genesee Valley and country of the Senecas where he destroyed Indian villages on the present sites of Painted Post and Corning. Another important Indian village was located at the present site of Canisteo.

Under the old grant of James I, Massachusetts claimed title to a large part of the country now included in New York State. New York, in order to settle this claim, ceded the rights of preemption to nearly 10,000 square miles, of which Steuben County was a part, retaining sovereignty and jurisdiction over the area itself. In 1788, Phelps and Gorham purchased from Massachusetts the preemptive rights and then proceeded to buy and extinguish the Indian title, thereafter selling large tracts to speculators. The land was owned successively by Robert Morris, Charles Williamson, and Sir William Pulteney. To Captain Williamson is due the credit for extensive improvements. He improved the navigation of Canisteo, Cohocton, and Chemung Rivers and built roads, bridges, schools, and courthouses.

The first white settlement in the country now included in Steuben County was made in 1786 on the present site of Painted Post. During 1789, people from Vermont settled at Corning. Bath, the county seat, dates from 1792. The county was formed from Ontario County in 1796 and was named in honor of Baron von Steuben of Revolutionary fame.

In the early days, much attention was given to the burning of timber, the ashes furnishing an important source of revenue for the settlers. Sawmills were later established, and they marked the beginning of an extensive lumber industry. Other early industries were tanneries, distilleries, and carding and cloth-dressing mills. All these were located along streams where water power was available.

After clearing the land, corn, wheat, oats, and barley were planted. The surplus grain, together with lumber and other products, were shipped to markets in Baltimore, by way of Chemung River to Susquehanna River.

A survey of the county made during 1845 lists 310 sawmills, 42 gristmills, 26 asheries, 35 tanneries, and 23 carding machines. The total value of the products of these mills amounted to $868,063, of which lumber contributed 45 percent.

The population has steadily increased since the county was formed. In 1850 it was 63,771 and in 1930 was 82,671. In 1930 the urban population was 38,590 and the rural 44,081. Corning with 15,777 inhabitants and Hornell with 16,250 are the largest cities. Important villages are Bath, Painted Post, Canisteo, Wayland, and Addison.

The county is well supplied with rail transportation. The Erie Railroad enters the southeastern part, extending west to Painted Post where it divides, the main line continuing along Canisteo River through Hornell to Buffalo, and the other following the Cohocton Valley through Bath and Wayland to Rochester. The Delaware, Lackawanna & Western Railroad enters east of Corning and proceeds along the Cohocton Valley to Buffalo. A branch line of the New York Central crosses the southwestern part of the county. Other railroads are the New York & Pennsylvania, the Baltimore & Ohio (Buffalo & Susquehanna branch), and the Pittsburgh, Shawmut & Northern. The first railroad to enter the county was the Erie, which reached Corning in 1848 and Hornell in 1850.

The main highway system is complete, with all the through routes paved. Although there are 2,868 miles of unimproved dirt roads, they are for the most part well maintained. No point is more than 3 miles from an improved road.

CLIMATE

The climate of Steuben County is typical of that of the southern tier of counties of western New York. It is characterized by rather long winters, with occasional periods of extremely low temperatures, and short cool summers. Because of the range in elevation, from 710 to 2,500 feet, many local variations in climate occur, determining to a great extent the kind of crop grown. In general, the winters are colder in the southern and southwestern parts of the county, the summers are cooler, the annual precipitation is greater, and the growing season is shorter by 2 or 3 weeks.

Records at South Canisteo, located in the southwestern part of the county, show an average annual precipitation of 41.43 inches and at Atlanta, in the northern part, 37.21 inches. The frost-free season at South Canisteo is 119 days and at Atlanta is 147 days.

Keuka Lake has a tempering influence on the climate of the section adjacent to it. Records at Penn Yan, situated at the north end of the lake in Yates County, apply in a general way to conditions at Hammondsport at the south end of the lake. At Penn Yan the average date of the last killing frost is May 4 and of the first is October 12, giving a frost-free period of 161 days. The long growing season has been responsible in part for the development of the grape-growing industry along the borders of Keuka Lake.

Weather Bureau records at Addison, which is situated in a deep narrow valley at an elevation of 990 feet, may be considered typical for most of the county. They show an annual rainfall of 33.15 inches, 53.5 percent of which falls during the period from May to September, inclusive. The precipitation is greatest in the summer and least in the winter. However, the distribution of the precipitation is rather uniform, sufficient rain falling during the growing season for all crops common to the county.

The mean annual temperature is 47.7° F., with a recorded minimum of −35° and a maximum of 106°. The average frost-free season covers a period of 136 days, from May 20 to October 4, inclusive.

Table 1, compiled from records of the Weather Bureau station at Addison, gives the more important climatic data for Steuben County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Addison, Steuben County, N.Y.*

[Elevation, 990 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1891)	Total amount for the wettest year (1894)
	°F.	*°F.*	*°F.*	*Inches*	*Inches*	*Inches*
December	28.8	65	−26	1 93	2.96	2.93
January	24.7	71	−35	2 05	1 84	1.94
February	24 5	70	−26	1 65	2 89	1.89
Winter	26 0	71	−35	5 63	7 69	6 76
March	34 4	85	−22	2 31	2 12	1.06
April	46 1	92	1	2 84	1 44	6 60
May	57 1	98	21	3 76	32	9.70
Spring	45 9	98	−22	8 91	3 88	17.36
June	65 9	100	30	3 90	2 05	1.82
July	70.2	106	35	3.39	2 91	2.06
August	68 1	103	34	3.58	4 24	1.44
Summer	68 1	106	30	10 87	9 20	5 32
September	62.2	101	24	3 11	49	5 62
October	51 1	92	15	2 79	2 94	4 03
November	39.1	78	−3	1 84	1 64	1 42
Fall	50 8	101	−3	7 74	5 07	11.07
Year	47.7	106	−35	33 15	25 84	40.61

AGRICULTURE

The early settlers found vast forests of pine, oak, ash, maple, and other trees when they first arrived in Steuben County. There were a few clearings on the river flats where the Indians had located their villages and where they produced corn, vegetables, and fruit. The first task of the pioneers was to clear the land, and as there was no market for lumber, practically all the timber was burned, the ashes furnishing the only source of income of the settlers for several years. After navigation of the rivers was improved by Captain Williamson, an extensive lumber industry developed, the lumber being transported by rafts down Cohocton and Canisteo Rivers to Chemung River, thence to Susquehanna River and to markets in Pennsylvania and Baltimore.

The manufacture of lumber was much more profitable than farming, consequently the development of agriculture was slow until much of the better timber had been removed. Some idea of the magnitude of the lumber industry can be gained from the fact that 310 sawmills were operating in the county as late as 1845. In certain towns in the southwestern part, lumbering continued to be the most important industry until comparatively recent years.

After the removal of the best timber, the lumbermen moved farther west, their place being taken by a new class of people, most of whom were experienced farmers from the Mohawk Valley and from the Eastern States. They brought with them superior livestock and better grains. Agricultural development from that time on was very rapid, both in livestock industries and grain production. In 1835, J. W. Prentiss planted grape cuttings in the town of Pulteney adjacent to Keuka Lake. His success with these marked the beginning of an extensive grape industry.

Livestock raising was important in the early agriculture, large numbers of young livestock being raised and driven to the eastern markets. Until 1900, Steuben County was one of the leading sheep-raising counties of the State. Swine were important in the early agriculture. A census of 1845 gives the following numbers of livestock: All cattle, 55,482; horses, 12,310; sheep, 217,658; and hogs, 35,987. Since that time there has been a steady decline in all classes of livestock except cattle.

That the dairy industry was important in 1845 is indicated by the products manufactured, which included 311,314 pounds of cheese and 1,838,420 pounds of butter. The peak in the number of cattle was reached during the decade 1870–80. Census reports for 1880 give the number of cattle, both dairy and beef, as 71,817. Since that time production of beef cattle has declined until on April 1, 1930, the 62,069 cattle in the county were almost exclusively of dairy breeds. Holstein-Friesian is the most popular breed, and herds of Guernseys and Jerseys are common. The extent of the dairy industry is shown by the following figures taken from the 1930 census reports: Cattle on farms, 62,069; and value of butter, cream, and whole milk sold, $3,883,384. Most of the milk produced was sold as whole milk, the value of which amounted to $3,576,396. The

transition from a butter and cheese industry to whole-milk production is largely because of the excellent rail transportation to large centers of consumption. Because of the high quality of the dairy herds, many cows and calves are sold out of the county for breeding purposes.

Sheep production was important in the early agriculture. In 1845 the number reported was 217,658, but the decline was steady after that until 1920, when the number had dropped to 30,238, but by 1930 it had increased to 35,634, and it will probably continue to increase because of the large acreage of abandoned land available for pasture. Prior to 1900, wool was the principal product, and fine wool breeds of sheep, such as the Merino, predominated. At present the most popular breeds are Shropshire and Hampshire Downs. The farm flocks are small, ranging from 15 to 100 head and averaging 40 head.

Hog raising is comparatively unimportant. The 1930 census reports 5,655 hogs, all of which are raised for home consumption.

Horses are used for most of the farm work, and the average number kept on a farm is three. No horses are raised in the county, all of them being shipped in from the Middle Western States. The price of a team of 1,300- or 1,400-pound horses averages about $300. Tractors are used to some extent, especially on the larger farms.

There is little intensive poultry production. All the farms have a flock of chickens, kept mainly for home use, and the surplus eggs are traded at local markets. On April 1, 1930, the number of chickens more than 3 months old was 316,149. In 1929, 2,690,207 dozens of eggs were produced, 2,097,484 dozens were sold, and 197,302 chickens were sold.

Table 2 gives the value of agricultural products in 1929, as shown in the 1930 census report.

TABLE 2.—*Value of agricultural products in Steuben County, N.Y., in 1929*

Crop	Value	Livestock and livestock products	Value
Cereals	$944,695	Domestic animals	$5,555,231
Other grains and seeds	224,043	Dairy products sold	3,883,384
Hay and forage	2,101,015	Poultry and eggs sold	953,124
Vegetables including potatoes	2,468,430	Wool	64,585
Fruits and nuts	421,411	Honey	24,090
All other field crops	49,018		
Total	6,209,212	Total	10,480,414
		Total agricultural products	16,689,626

The early system of agriculture was one of grain and livestock production, and it reached its peak between 1850 and 1860. From that period on the decrease in the quantity of grain produced for market and in the numbers of beef cattle and sheep raised has been gradual. Wheat was the most important crop during the early agricultural period, large quantities reaching market over the rivers. During 1845, wheat from 44,737 acres was harvested, yielding 457,304 bushels. Dairying increased rapidly after the advent of railroads in 1848, as these furnished a convenient outlet for the products.

At present the crops grown, ranking in order of their acreage, are hay, oats, potatoes, buckwheat, corn, wheat, field beans, and alfalfa. Hay is the one crop produced on all farms. Previous to 1910, large quantities were shipped to markets in the cities, but this practice has almost ceased. Timothy is the most important hay crop. In 1929, hay was cut from 148,405 acres, producing 142,098 tons, an average yield of nearly 1 ton an acre. Of the above acreage, 15,950 acres were devoted to clovers which returned an average acre yield of 1.4 tons.

Alfalfa has been steadily increasing in importance since 1900, when it was first introduced in the county. The census report gives an acreage of 3,193 in 1929, with an average yield of 1.8 tons an acre. This crop has great possibilities in Steuben County, especially on the valley soils. It makes a superior hay for dairy cattle, and, as dairying is the important industry, the production of alfalfa should be increased.

Oats, which occupy the second largest acreage, are utilized entirely on the farm as feed. During 1929, oats from 33,762 acres were harvested, yielding 613,434 bushels, and in addition those from 1,633 acres were cut and fed unthreshed. A mixture of oats and barley is not uncommon, and occasionally oats, barley, and peas are seeded together.

In total value, potatoes are the most important crop grown in Steuben County, which county ranks second in the State in potato production. In 1929 potatoes were grown on 17,043 acres, yielding 1,604,512 bushels. During the year 1909 potato production reached its peak, when 30,524 acres were devoted to the crop and 3,279,953 bushels were produced. Production has steadily declined since that year. Intensive potato production is limited to two well-defined areas. The most extensive of these includes the towns of Cohocton, Wayland, Avoca, Dansville, Prattsburg, and Fremont, in the northern and northwestern parts of the county. The other area, which is less extensive, includes the towns of Troupsburg, Greenwood, and West Union, in the southwestern corner. The soils and climatic conditions of these two sections are ideally adapted to potato production. Most of the potatoes are of the Rural group, 70 percent being White Rural. Some certified seed is grown, but the greater part of the crop goes to the large markets as table stock.

Steuben County is the leading buckwheat-producing county of the State. In 1929, 19,128 acres were harvested, yielding 172,883 bushels. This is an important crop grown almost entirely on the upland soils. A small quantity is used on the farms as feed, but most of the crop is marketed as grain. A large mill in Cohocton manufactures buckwheat flour.

Corn is not an important grain crop, because of the short growing season, although it can be grown with fair success on the river flats of the main valleys. Of 14,963 acres devoted to corn in 1929, that from 1,129 acres was harvested for grain and the rest was cut for fodder and silage.

The acreage devoted to wheat has declined steadily since 1879. During that year 33,622 acres were in wheat, but by 1929, the acreage had decreased to 4,371 acres. Most of the wheat produced is used as feed on the farms.

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Barley and rye occupy only very small acreages. In 1929, barley was produced on 4,646 acres and rye on 1,112 acres. Both grains are used for feed.

Field beans are an important cash crop through the Cohocton Valley and south from Wayland to Hornell on the valley soils. The 1930 census reports 4,301 acres devoted to this crop in 1929, yielding 48,475 bushels.

The acreage in tobacco, formerly an important crop, has declined, and in 1929 only 225 acres were devoted to this crop, the total yield amounting to 211,487 pounds. Tobacco is grown on the bottom soils bordering Chemung and Tioga Rivers.

Grape growing is an important industry in the section adjacent to Keuka Lake. In 1929, 6,147 acres were devoted to this crop, and the total yield was 8,003,271 pounds. The three important varieties of grapes are Delaware, Catawba, and Concord. Delaware and Catawba grapes, because a longer growing season is necessary for their maturity, are grown immediately adjacent to the lake, and the Concord, an earlier-maturing variety, can be successfully grown on the higher slopes. Many of the grapes are disposed of at roadside stands, part are trucked to distant cities, and part are manufactured into grape juice at Hammondsport.

Aside from grapes, fruit growing is of little importance in Steuben County. Small orchards are on practically all the farms, but no attempt is made to care for the trees, consequently little fruit is produced except for home use.

Table 3 gives the acreage and yield of the principal crops of the county in stated years, as reported by the census.

Steuben County, with a land area of 894,720 acres, has 79 percent, or 706,899 acres, in farms, of which 347,730 acres are classed as crop land, 234,994 acres as pasture land, and 83,377 acres as woodland covered by second- and third-growth trees. Some merchantable timber is cut from the woodland, also some firewood and fence posts for farm use. In 1929, 7,139,000 board feet of saw and veneer logs, 456,162 fence posts, and 10,538 crossties were cut for sale.

TABLE 3.—*Acreage and production of principal crops in Steuben County, N.Y., in stated years*

Crop	1889		1899		1909	
	Acres	*Tons*	*Acres*	*Tons*	*Acres*	*Tons*
Hay	181,759	218,242	182,473	165,636	185,682	159,281
Alfalfa			46	106	230	743
Corn for silage						
		Bushels		*Bushels*		*Bushels*
Buckwheat	33,230	598,262	30,149	311,340	25,867	341,264
Potatoes	17,544	1,213,837	26,468	2,702,304	30,524	3,279,953
Oats	72,706	1,903,937	72,575	1,794,070	70,992	1,216,138
Wheat	10,779	158,670	18,180	278,580	8,783	168,160
Field beans		4,519	2,642	25,836	632	7,128
		Pounds		*Pounds*		*Pounds*
Tobacco	621	674,380	1,835	2,569,560	789	979,886
	Vines		*Vines*		*Vines*	
Grapes			3,371,324	19,538,100	2,568,026	17,509,702

TABLE 3.—*Acreage and production of principal crops in Steuben County, N.Y., in stated years*—Continued

Crop	1919		1929	
	Acres	*Tons*	*Acres*	*Tons*
Hay	201,064	209,106	148,405	142,098
Alfalfa	618	1,210	3,193	5,903
Corn for silage	7,267	70,584	9,056	68,837
		Bushels		*Bushels*
Buckwheat	15,877	241,929	19,128	172,883
Potatoes	10,013	2,176,313	17,043	1,604,512
Oats	52,684	1,383,541	33,762	613,434
Wheat	11,073	208,855	4,371	72,832
Field beans	1,880	----------	4,301	48,479
		Pounds		*Pounds*
Tobacco	483	590,824	225	211,487
	Vines		*Vines*	
Grapes	2,547,715	9,334,825	2,298,681	8,003,271

The average size of farms in 1930 was 137.4 acres, an increase of nearly 14 acres a farm since 1920. The number of farms has decreased from 8,321 in 1880 to 5,143 in 1930. The size of farms differs according to their location. The smallest are in the towns of Urbana and Pulteney, averaging 85 acres, and the largest in the town of Hartsville where the average size is 208 acres. In general, the farms are smaller in the more intensively cultivated sections, as along Keuka Lake and through the northwestern part of the county, than they are through the southern half.

Contrasting two towns which are representative of the two most important types of agriculture—potato production and dairying—the following differences are noted. The town of Wayland has farms averaging 106 acres in size, 76 percent of which is plow land. Hartsville town, with farms averaging 208 acres in size, has only 46 percent of plowable land. In the town of Wayland 79 percent of the land is cleared, and in the town of Hartsville 56 percent is cleared. The percentages for cropped land are 59 percent in Wayland and 30 percent in Hartsville. Abandoned and idle land accounts for 7.2 percent of the total of the town of Wayland and 10.5 percent of the town of Hartsville. Dividing the county into two parts, the dividing line coinciding with the northern boundaries of the towns of Hartsville, Canisteo, Cameron, Thurston, Campbell, and Hornby, the figures for Wayland would represent the part north of this line and those for Hartsville the part south.

Most of the farmers are descendants of the original settlers, although in recent years a rather large number of Poles from Pennsylvania have purchased farms in the county. The 1930 census returns give the percentage of native-white farmers as 96 percent.

In 1930, of the 5,143 farms in the county 3,809, or 74 percent, were operated by their owners, 518 farms were partly owned by the operator, and 771 were operated by tenants, 80 percent of whom farmed on the share basis. The customary system of rental is for the owner to pay the taxes and for expensive repairs and to furnish half the fertilizer used and half the seed. In return he receives one half of the farm produce

The total value of land and buildings in 1930 amounted to $26,436,523, and land alone had a value of $10,947,489. The average values of a farm were as follows: Land and buildings, $5,140, and buildings alone, $3,011, of which the home accounted for $1,474 and all other buildings $1,537. The average acre value of land and buildings was $37.40, a decrease from $40.28 since 1920. There is a wide difference in land values in different parts of the county. The average acre value for the town of Wayland, which is one of the best agricultural towns, is many times that of the town of Hornby, the difference being due to differences in the soil and topographic conditions of the two towns.

Most of the farms are well equipped with machinery. The average value of machinery on a farm in 1930 was $979. The 1930 census reports 1.247 tractors and 1,264 motor trucks in the county. Telephones were in 2,936 farm homes, and 808 homes were lighted by electricity. Farms located on concrete roads numbered 428, on macadam roads 1,113, and on improved dirt roads 93.

SOILS AND CROPS

Steuben County lies in a dissected plateau region, the only remaining remnants of the plateau consisting of the tops of ridges and hills, some of which have a level or flat surface relief. These flat-topped ridges are most strikingly developed north of Cohocton River. The area was originally covered with vast forests of conifers and hardwoods. Clearing the land for agriculture progressed more rapidly in the northern and northwestern parts of the county, largely because the topography was less rugged, the region was more accessible, and the soils in general were superior to those predominating in the southern half.

The percentage of abandoned land is greater in the northern towns, because, when settlement became rapid, the land was indiscriminately cleared, regardless of its suitability for farming, consequently the areas of poor soils were subsequently abandoned; whereas, in the southern part, as clearing was done at a later date, only the more favorably situated areas were brought under cultivation and, as a result, have remained in production.

The present system of agriculture, which consists of dairying, potato production, and viticulture, has developed because of the operation of several factors, the more important of which are geographic location with respect to markets and local natural conditions, such as climate, soil, and relief.

Steuben County lies in a region of well-distributed and moderate rainfall. The mean annual temperature of 47.7° F. is typical of that for southwestern New York, which in general is characterized by long moderately cold winters and short cool summers. Climatic conditions have allowed the development of a system of general farming based on dairying and potato production. The tempering effect of Keuka Lake on the climate of the adjacent slopes has resulted in the development of viticulture as the dominant industry of the section near the lake.

The dairy industry, which consists mainly of the production of whole milk, has become important because the county has fast and

direct rail connection with centers of consumption. Climatic factors and soil conditions over a large proportion of the county are such as to limit the crops that can be produced with any degree of success to those which may be fitted easily into a dominant dairying industry. Cool growing seasons, with good distribution of rainfall, favor the growth of good pasture grasses. Land values are low, consequently large areas can be economically used as pasture. The percentage of the total land in farms classed as pasture land is 33.2 percent; hay land accounts for an additional 21 percent, giving a total of 54.2 percent of all lands in farms utilized directly for maintenance of livestock. As the soils over a large part of the county are heavy in texture and poorly drained, they are best suited to the production of hay, grasses for pasture, and small grains.

Potatoes are adapted to those parts of the county wherein they are the dominant crop because of soil and climatic conditions. The soils in general are light or medium textured, friable, and well drained. Such soils occur predominantly in the uplands and on the slopes at high elevations where danger from blight is less than in the valleys. Potatoes require a cool growing season with a good distribution of moisture. The mean summer temperature in Steuben County is 68.1° F., and the rainfall is well distributed, 53.5 percent of the total falling during the months of May to September, inclusive, with an average of 3.55 inches a month.

The production of grapes is confined to a rather narrow belt bordering Keuka Lake where the length of the growing season, owing to the tempering influence of the lake, ranges from 3 to 5 weeks longer than in other parts of the county. The belt is narrow, not exceeding a width of 2½ miles back from the lake. Slopes so steep that they would otherwise be of no value for crop production are utilized for vineyards.

The alternate beds of shales and sandstones underlying the soils of Steuben County are covered with a mantle of glacial drift of variable thickness. The glacial material of the uplands is composed mainly of decomposed material from the local underlying rocks, and that in the valleys, deposited mainly through the action of water, contains a considerable proportion of limestone and other rock material brought in from regions to the north.

The county lies in the intergrade region between the podzol soil region of the North and the gray-brown podzolic soil region of the northeastern United States—the higher country, or plateau, lying in the region of podzol soils and the valleys in the region of gray-brown podzolic soils. Before being brought under cultivation, this part of New York was covered with forests of white pine and hardwoods consisting principally of maple, beech, birch, oak, hickory, and ash.

The soils of Steuben County fall naturally into two groups, upland soils and valley soils including soils derived from valley till material. The soils derived from valley till material are not in a strict sense valley soils, but are intermediate between true valley soils and upland soils. Typically developed, they occur on the lower slopes immediately above the valley floor, but they are not confined to such a position. In the towns of Cohocton, Fremont, and Dansville soils of this character lie at elevations approaching 2,000 feet.

In total acreage the upland group of soils is the most important, occupying 76 percent of the land area of the county. Because of their wide distribution, the cropping characteristics of these soils have determined the trend of agriculture.

The well-drained upland soils, which include the Lordstown, Angola, Cattaraugus, and Bath soils, are dominant in the northwestern and southwestern parts of the county. It is in those sections that potato production has reached its highest development because the soils are especially well adapted to this crop. Not only are better potato yields obtained on these soils, but small grains, silage corn, and hay crops give greater returns.

The imperfectly and poorly drained upland soils are distributed over the entire county, with the exception of the northwestern corner. Dairying has developed as the major industry on these soils, because their physical characteristics limit the crops which can be grown with any degree of success to small grains, grasses for pasture, and hay crops, such as timothy and clover. The elevation at which these soils are found is so great, with a consequent short growing season, that silage corn, which is necessary for dairying, is not a successful crop. Potatoes can be grown with moderate success, and the agriculture has developed in this direction.

The imperfectly drained upland soils are correlated in the Mardin, Hornell, and Langford series; the poorly drained upland soils are members of the Fremont, Volusia, Erie, and Allis series; and the permanently wet upland soils are included in the Chippewa and Norwich series. Many abandoned farms in the uplands are located on the poorly drained soils. The soils of this subgroup are distinctly inferior in productive capacity to the imperfectly drained soils.

The valley soils, although they cover only 24 percent of the total area of the county, are, nevertheless, highly important agricultural soils. They are subdivided into well-drained valley soils from ice-laid deposits, well-drained valley soils from old water-laid deposits, well-drained alluvial soils, imperfectly drained valley soils, and poorly drained valley soils. The reaction of the subsoil material is also used as a basis for subdivision.

The system of agriculture followed on the valley soils is one of general farming, with dairying as the principal industry. The soils are well adapted to all the crops common to the county. Higher yields of small grains, silage corn, and hay are obtained on the valley soils than on the upland soils. Alfalfa growing is at present entirely confined to soils occurring in the valleys. The alkaline, well-drained, friable, and gravelly subsoil characteristics of many of the valley soils are favorable to this crop. Besides forage crops necessary for dairy cattle, dry beans, canning peas, and potatoes are important crops grown on the valley soils.

Well-drained valley soils from ice-laid deposits are members of the Wooster and Lansing series; those from old water-laid deposits are classified in the Howard, Arkport, Dunkirk, Groton, Chenango, and Otisville series; the well-drained alluvial soils, in the Chagrin and Tioga series; the imperfectly drained valley soils, in the Caneadea, Middlebury, and Eel series; and the poorly drained valley soils, in the Wayland and Holly series.

A high percentage of the total acreage of the valley soils is under cultivation, but some areas, because of rough surface relief or water-soaked condition, are utilized only as pasture. The soils with rough surface relief, representing morainic deposits, are included in the Groton and Otisville series. The excessively wet soils, consisting mainly of swamps, are included in the Holly and Wayland series.

The areas of muck that have been reclaimed are used exclusively for vegetable production. The largest and most important areas lie north of Hornell along the county line. The muck is alkaline and is underlain by beds of marl in many places. Areas of undifferentiated alluvial soils are also mapped.

In the following pages of this report the soils of Steuben County are described in detail and their agricultural relationships are discussed; their location and distribution in the county are shown on the accompanying soil map; and their acreage and proportionate extent are given in table 4.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in Steuben County, N.Y.*

Type of soil	Acres	Percent
Bath gravelly silt loam	24,704	2 7
Bath gravelly silt loam, stony phase	1,280	1
Bath gravelly loam	7,808	9
Bath gravelly loam, steep phase	896	1
Bath silt loam	1,984	2
Bath stony silt loam, steep phase	3,008	3
Lordstown stony silt loam	123,328	13 8
Lordstown stony silt loam, steep phase	88,128	9 8
Lordstown gravelly silt loam	7,040	8
Angola gravelly silt loam	1,664	.2
Cattaraugus silt loam	11,200	1 2
Cattaraugus gravelly loam	10,368	1.1
Cattaraugus gravelly loam, steep phase	576	.1
Mardin gravelly silt loam	171,008	19 1
Mardin gravelly silt loam, deep phase	192	.1
Mardin gravelly silt loam, steep phase	4,864	.6
Mardin stony silt loam, steep phase	1,024	.1
Langford silt loam	11,200	1 2
Langford silt loam, steep phase	448	1
Hornell silty clay loam	5,184	6
Hornell silty clay loam, steep phase	1,472	2
Fremont gravelly silt loam	50,688	5 7
Fremont gravelly silt loam, stony phase	704	1
Fremont silt loam	12,544	1 4
Volusia gravelly silt loam	60,224	6.7
Volusia gravelly silt loam, stony phase	768	1
Volusia silt loam	320	.1
Volusia silt loam, dark-colored phase	2,496	.3
Volusia silt loam, shallow phase	9,472	1 0
Erie gravelly silt loam	39,488	4.4
Allis silty clay loam	960	1
Allis gravelly silt loam	4,480	5
Allis gravelly silt loam, steep phase	256	.1
Chippewa gravelly silty clay loam	14,912	1.7
Norwich gravelly silty clay loam	4,224	5
Wooster gravelly silt loam	38,976	4 3
Wooster gravelly silt loam, steep phase	1,536	2
Wooster gravelly loam	8,512	.9
Wooster gravelly loam, steep phase	2,880	.3
Wooster stony silt loam	15,936	1 8
Wooster stony silt loam, steep phase	1,728	2
Wooster silt loam, calcareous phase	4,096	0 4
Lansing gravelly silt loam	4,800	.6
Chenango gravelly silt loam	22,080	2.5
Chenango silt loam	2,176	.2
Chenango gravelly loam	12,608	1 4
Chenango loam	1,728	.2
Chenango fine sandy loam	1,024	.1
Chenango very fine sandy loam	512	.1
Chenango gravelly sandy loam	2,752	.3
Howard gravelly silt loam	3,648	4
Howard gravelly loam	6,208	.7
Howard fine sandy loam	2,304	.2
Arkport fine sandy loam	1,216	.1
Arkport fine sandy loam, steep phase	2,240	.2
Arkport gravelly loam	4,096	.4
Dunkirk silt loam	1,920	.2
Dunkirk silt loam, rolling phase	2,112	2
Groton gravelly loam	8,960	1 0
Groton fine sandy loam	384	.1
Otisville gravelly loam	5,632	6
Chagrin silt loam	11,072	1 2
Chagrin silt loam, high-bottom phase	1,600	.2
Chagrin silt loam, dark-colored phase	128	.1
Chagrin loam	1,600	.2
Tioga silt loam	5,760	.7
Tioga silt loam, high-bottom phase	2,048	.2
Tioga fine sandy loam	1,856	.2
Caneadea silty clay loam	1,472	.2
Caneadea silt loam	1,792	.2
Middlebury silt loam	576	.1
Middlebury silt loam, high-bottom phase	3,328	.3
Middlebury silty clay loam	640	.1
Eel silt loam	192	.1
Eel silt loam, high-bottom phase	1,024	.1
Eel silt loam, dark-colored phase	1,152	.1
Eel clay loam	384	.1
Wayland silt loam	2,944	.3
Wayland silty clay loam	448	1
Wayland clay loam	1,984	.2
Holly silty clay loam	6,656	.8
Carlisle muck	2,368	.2
Carlisle muck, shallow phase	1,088	1
Alluvial soils, undifferentiated	5,632	.6
Total	894,720	-----

UPLAND SOILS

WELL-DRAINED UPLAND SOILS

The soils of this group, including members of the Lordstown, Angola, Cattaraugus, and Bath series, cover a greater proportion of the total land area of the county than those of any other group, but as many areas of steep rough nonagricultural land are included in the Lordstown soils, the total farm land is less than that of the imperfectly drained upland soils.

The well-drained upland soils occupy the higher ridges, summits, and all the rough steep slopes of the county. The agricultural lands have a rolling, level, or gently sloping surface relief and are characterized by brown or grayish-brown surface soils and friable well-drained subsoils, and, as a rule, contain much stony material. Some imperfectly drained areas have been included in the heavier types of the Cattaraugus soils, but these soils as a whole are well drained, which is reflected in the crop yields.

The soils of this group have been derived from decomposed material from local shale and sandstone bedrock, and they contain no crystalline, igneous, or limestone materials, except certain areas of the Lordstown soils, where the local rock is calcareous.

Bath gravelly silt loam.—The surface soil of Bath gravelly silt loam, to a depth of 10 inches, consists of rich-brown, yellowish-brown, or grayish-brown (when dry) friable silt loam, in most places containing a high percentage of small thin fragments of shale and sandstone. The upper part of the subsoil, extending to a depth of about 24 inches, is rust-brown or yellowish-brown friable silt loam which, like the surface soil, contains many small stone fragments. The color of the material in this layer grades from rust brown at a depth of 10 inches to yellowish brown at a depth of 24 inches. The lower part of the subsoil, to a depth of 36 inches, is composed of yellowish-gray or drab slightly compact silt loam mottled in places with gray, yellow, and brown. The stone fragments increase in size with depth, some attaining dimensions ranging from 8 to 12 inches in diameter at a depth of 3 feet. The parent material, or substratum, is hard compact drab or greenish-gray unweathered till which is somewhat heavier in texture than the material in the layers above and contains a greater proportion of stony material.

The quantity of stone fragments scattered over the surface and through the soil differs in different areas. Most of the Bath soils mapped in the northern and northwestern parts of the county have more gravel on the surface than the same soils mapped in the southwestern part. The gravel in the northern part is composed of small thin angular fragments of dense fine-grained sandstone, but that in the southwestern part is more massive in character and is composed of coarse-grained sandstone.

Bath gravelly silt loam occurs on the smoother lands in the upland parts of the county. The level areas occupy the tops and crests of ridges, most of which, owing to the horizontal position of the underlying rocks, are flat. The soil mantle of these flat areas is inclined to be thin, although the bedrock in few places is close enough to the surface to interfere with cultivation. This soil and members of the Bath series in general result from the weathering of a mantle of

glacial till derived entirely from the underlying shales and sandstone, as no foreign rocks of any kind occur in these soils.

The Bath soils are rather closely related to the Lordstown and Wooster soils, occupying a position intermediate between the soils of these two series. They occupy the same topographic position as the Lordstown soils, but the profile resembles that of the Wooster soils, differing in the more compact character of the subsoil, in the lack of foreign rock materials, and in the color of the surface soil and upper subsoil layers which in the Bath soils are somewhat more intensely brown. Because of the resemblance between the soils of the three series, the boundaries, where all three occur in close association, may be arbitrarily drawn in places.

Bath gravelly silt loam ranks high as an agricultural soil and is probably the best upland soil in the county. It might be classed as the key soil of the series, both as regards productivity and extent, as it excels the other Bath soils in both respects. The medium-textured gravelly surface soil and friable well-drained subsoil cause it to be ideally adapted to potato production. This soil, together with Wooster gravelly silt loam and Wooster gravelly loam, are the leading potato soils of the county. Not only potatoes, but oats, timothy, and clover are grown with excellent results. Corn and buckwheat are grown to some extent, the corn being used for silage. The growing season is usually too short for corn to mature, as the elevation at which this soil occurs in many places exceeds 2,000 feet.

Bath gravelly silt loam, stony phase.—Aside from the gravel and stone content of this soil it closely resembles typical Bath silt loam, both in profile characteristics and agricultural adaptations. It has a yellowish-brown topsoil underlain by a grayish-yellow or drab compact and hard subsoil. Scattered over the surface and through the soil is a large quantity of angular shale and sandstone fragments ranging from 1 to 10 inches in diameter. In many places the number of larger fragments is sufficient to materially interfere with cultivation.

This is not an important soil because of its low agricultural value and small extent. It occurs in close association with the Lordstown, Fremont, and Mardin soils in the towns of Erwin and Campbell.

Bath gravelly loam.—The topmost 8 inches of Bath gravelly loam is yellowish-brown or rust-brown friable gravelly loam containing a noticeable quantity of grit. Between depths of 8 and 12 inches a rich rust-brown moderately compact layer occurs in places, but in areas in which the soil has long been under cultivation, the material has become disseminated, imparting a more intense color to the surface soil. The upper subsoil layer, between depths of 12 and 22 inches, consists of light yellowish-brown loamy fine sand which is friable in the upper part but becomes slightly compact at a depth of 20 inches. This layer contains a few sandstone fragments. The material to a depth of 30 inches is moderately compact loamy sand which becomes slightly mottled as depth increases. The substratum is compact fairly hard gritty silt loam with a greenish-gray cast. The gravel in this soil consists of small fragments of a green-tinted sugary sandstone, with an occasional piece of conglomerate. A few areas have sufficient coarser material over the surface to be classed as stony.

This soil is similar to Bath gravelly silt loam in topographic position, occurring on the tops of hills and having a moderately rolling surface. It is mapped principally in the southwestern part of the county.

Bath gravelly loam is not so productive as Bath gravelly silt loam and is not so generally under cultivation. Many abandoned farms are in evidence throughout the section where this soil occurs. Good crops of potatoes can be produced with proper fertilization. Meadows yield fair crops of hay, although the soil is strongly acid and requires lime for growing clovers. Much of the land is forested with second-growth maple, beech, and white pine.

Bath gravelly loam, steep phase.—The steep phase of Bath gravelly loam is similar in profile characteristics to typical Bath gravelly loam, although in general it is somewhat more stony. Less of it is under cultivation, and a higher percentage is in forest. The separation is based entirely on the degree of slope of the land. These steep areas are of small extent and low agricultural value.

Bath silt loam.—The surface soil of Bath silt loam is pale-yellow or yellowish-brown mellow friable silt loam extending to a depth of 8 or 10 inches, where it grades into pale-yellow slightly compact gritty silt loam. This layer extends to a depth of about 2 feet, below which the soil material becomes moderately compact, grayish yellow in color, and somewhat lighter in texture. The lower subsoil layer is gray with a green cast, is moderately compact, and contains a few angular sandstone fragments. Bedrock is present in places at a depth of about 4 feet. In some places a few sandstone fragments are scattered over the surface, although the soil as a whole is stone free.

This soil occurs on the summits of hills and on the more gentle slopes, and it has a smooth or gently rolling surface relief. It is of small extent and is mapped only in the towns of Cameron, Rathbone, Thurston, and Addison. It is not important agriculturally. The principal crops produced are hay, oats, and buckwheat. Some of the land has been abandoned.

Bath stony silt loam, steep phase.—The profile characteristics of the steep phase of Bath stony silt loam do not differ essentially from those of Bath gravelly silt loam except that the shale and sandstone fragments are larger and more abundant. The separation was made on the basis of topographic position, this stony soil occurring on slopes steep enough to reduce the value of the land for cultivated crops, as machinery cannot be used to the best advantage. A large proportion of the potatoes grown on this soil are planted and harvested by hand.

A large acreage still remains in forest of second-growth hard maple, beech, and hemlock. The more gentle slopes, where cleared, are cropped in a manner similar to Bath gravelly silt loam, but a greater proportion of the stony soil is used as pasture and hay land.

Lordstown stony silt loam.—The 8-inch surface soil of Lordstown stony silt loam consists of light-brown, grayish-brown, or yellowish-gray friable silt loam. It is underlain by light grayish-yellow heavy silt loam which is slightly more compact than the surface soil and extends to a depth of about 20 inches. From this depth to the underlying rock, which in most places is within a depth of 3 feet from the

surface, the material is gray or light yellowish-brown somewhat compact, though still friable, silt loam. Scattered over the surface are different quantities of shale and sandstone fragments from 1 to 10 inches in diameter. The proportion of such material is somewhat greater in the subsoil than in the surface soil. The underlying rocks are the only source of this stony material, and igneous or crystalline rocks are not present. The soil is noncalcareous throughout.

The Lordstown soils are derived from a thin mantle of glacial till formed from the underlying shale and sandstone rocks. The depth of the deposits in few places exceeds 3 feet, and narrow ledges and outcrops are common. The bedrock is in few places close enough to the surface to seriously interfere with cultivation.

Some difference in color of the surface soil occurs in different parts of the county. In close association with the Wooster and Bath soils, the color is brown rather than gray, and the upper subsoil layer may have a rust-colored cast. This difference occurs in areas of Lordstown stony silt loam mapped in the northern and northwestern parts of the county, mainly in the towns of Wheeler, Cohocton, Dansville, and Avoca. This soil in the south-central and southeastern parts of the county has a gray or pale-yellow surface soil and a light-colored subsoil, but in all other characteristics the soil is uniform.

Lordstown stony silt loam, in general, occupies the better-drained slopes and the higher uplands. The tops of some of the hills mapped as Lordstown soil have a level or flat surface relief, owing to the nearly horizontal position of the underlying rocks. For the most part, however, the surface relief is rolling or moderately steep. Drainage is good, as the friable subsoil allows ready movement of water and the sloping or rolling surface provides adequate drainage. On the steeper areas, from which the forest has been removed, soil washing is likely to occur if cultivated crops are grown.

With favorable relief and not too great a stone content, Lordstown stony silt loam is an excellent soil. Dairying is the main agricultural industry, with timothy and clover, oats, buckwheat, and corn for silage the most important crops grown. Good yields are obtained, although lime is necessary for the best success with clover. Potatoes are an important cash crop and do exceptionally well. This crop is especially important where the Lordstown soils are associated with the Bath and Wooster soils in the northern and northwestern parts of the county.

Lordstown stony silt loam, steep phase.—The steep phase of Lordstown stony silt loam is mainly a separation based on topographic position and surface relief. It is, in general, a nonagricultural soil, owing to its steepness and to the numerous outcrops of the underlying rocks. Included with soil of this phase are areas that might well be classed as rough broken land, such as the steep, precipitous slopes and perpendicular cliffs bordering Canisteo River between Canisteo and Addison. This soil is fairly uniform as described, although some scattered areas have less stone on the surface and the degree of slope is less. Most of such areas are cleared and under cultivation or are used as pasture.

Lordstown gravelly silt loam.—Lordstown gravelly silt loam has an 8- to 10-inch surface soil consisting of rich-brown, yellowish-

brown, or light grayish-brown friable silt loam. The upper subsoil layer, to a depth of 20 inches, is friable smooth silt loam having a fairly rich brown color in the upper part, changing to lighter yellow at a depth of 18 inches. The next lower layer extending to bedrock, which in most places occurs at a depth of about 3 feet, is grayish-brown or gray light silt loam.

The gravel in this soil consists of numerous small angular fragments of shale and sandstone. More gravel is scattered over the surface and through the topsoil than occurs in the underlying layers. The size and quantity of the fragments are the characteristics which distinguish this soil from Lordstown stony silt loam, although, in general, the gravelly silt loam may have a browner surface soil.

Lordstown gravelly silt loam does not differ greatly from Bath gravelly silt loam. Boundaries between these two soils are necessarily arbitrary in places, as the distinction is based entirely on depth, the Lordstown soil being shallow, whereas the Bath soil is deep.

Lordstown gravelly silt loam occurs predominantly on level or moderately rolling hilltops, though in some places it occupies moderately steep slopes. Like Lordstown stony silt loam it has been derived from a thin mantle of glacial till composed of the decomposed local shale and sandstone bedrock. The soil is acid throughout.

Lordstown gravelly silt loam is not so important an agricultural soil as Lordstown stony silt loam, mainly because it is smaller in extent, but the same crops are grown and the yields are about the same. Corn cannot be grown with much success, owing to climatic conditions rather than to soil conditions.

Most of this soil occurs in the northeastern part of the county north of Cohocton River at elevations of 2,000 or more feet. Consequently the growing season is too short for corn to mature. The soil is well adapted to potatoes, as its light texture, friability, and well-drained subsoil are well suited to this crop.

Angola gravelly silt loam.—Angola gravelly silt loam has a 6- to 10-inch surface soil consisting of brown or grayish-brown loose friable silt loam which contains many angular sandstone fragments. The subsoil to bedrock, which in most places lies above a depth of 3 feet, is composed of light-yellow or grayish-yellow friable gritty silt loam or loam and is slightly compact in the lower part of the layer. Like the surface soil the subsoil also contains many stone fragments.

This soil is typically Lordstown silt loam in character and description, but it differs from that soil in that the parent rock carries sufficient calcareous fossils to produce effervescence with dilute hydrochloric acid. The calcareous material furnishes a slight quantity of lime to the soil over these very local areas, and its occurrence is indicated only by the surface exposure of the rock and the extent and character of the thriftiness of the crops adjacent to such exposures. The extent of the calcareously influenced areas of this Lordstown soil variation is highly problematical.

Cattaraugus silt loam.—The Cattaraugus soils really represent an intergrade between the well-drained soils and the imperfectly drained soils. Cattaraugus gravelly loam is well drained, but the silt loam in places is inclined to imperfect drainage.

The surface layer of Cattaraugus silt loam is brown or pinkish-brown gritty heavy loam or gravelly silt loam with a few sandstone and shale fragments scattered over the surface. It is friable, mellow, and moderately supplied with organic matter. The subsurface material, to a depth of about 15 inches, is light brownish-pink or light-brown gritty silt loam which is somewhat compact and has slight mottling in the lower part in places. Between depths of 15 and 24 inches is gray-brown or pinkish-brown compact gritty gravelly loam which in places is mottled faintly with gray. The lower part of the subsoil, from a depth of 2 feet downward, is composed of dark reddish-brown gritty silt loam or heavy silt loam, which is very hard and compact and contains many fragments of sandstone and shale. In some places the soil may have enough shale and sandstone fragments scattered over the surface to be classed as stony, but such areas are very small. They are shown on the map by stone symbols.

The surface relief of Cattaraugus silt loam ranges from moderately to strongly rolling, with a few slopes which are so steep as to impede cultivation.

This is the most important Cattaraugus soil in the county, both in agricultural value and in the acreage mapped. It is a fairly good potato soil, most of the potatoes produced in the southwestern part of the county being grown on it. Hay is grown on the largest acreage, with oats and buckwheat following. Clover can be grown, but it requires an application of lime for success. Corn cannot be grown to advantage, as this soil occurs at so great an elevation that the growing season is markedly shorter than in other parts of the county. Much of the land still remains in forest, mainly of second-growth hemlock, maple, and white pine. Very little of this land has been abandoned because it was not cleared until recently and then only the more favorably located areas.

The Cattaraugus soils have developed from glacial-till material derived from the local shales and sandstones. In this section of the county, part of the underlying rock is composed of red and green sandstone and shale, which have contributed the red color to the soils. These soils occur mainly in the towns of West Union and Greenwood in the southwestern corner of the county.

Cattaraugus gravelly loam.—The surface soil of Cattaraugus gravelly loam is dark reddish-brown, dark-red, or pink friable gravelly loam to a depth ranging from 5 to 7 inches, where the material grades into reddish-brown or rust-brown gritty silt loam containing a few angular pieces of sandstone. The subsoil, to a depth of about 48 inches, is dark-red hard and compact, heavy silt loam, in places showing greenish-gray and brown mottles. Below a depth of 48 inches the material is dark-red tight and compact unweathered till having a soapy, slick appearance.

Scattered over the surface of this soil, but occurring sparingly throughout the soil, are large sandstone boulders. In many places the underlying rock lies close to the surface or protrudes above. The soil occurring on the lower slopes is generally deeper and not so stony, and the upper subsoil layer may show a somewhat mottled appearance.

Cattaraugus gravelly loam occurs predominantly on slopes, although in places it occupies rolling hilltops. This soil as mapped on

the lower slopes is inclined to be strongly rolling or morainic in character.

This soil is not very important agriculturally, largely because of its topographic position and stony condition, but where favorably located it produces good crops of timothy, oats, and buckwheat. Potatoes are grown on a very small acreage. A large proportion of the land still remains in forest of second-growth hard maple, hemlock, and beech.

Cattaraugus gravelly loam, steep phase.—The steep phase of Cattaraugus gravelly loam differs from the typical soil only in surface relief. Surface drainage is excessive, and erosion is active on the cleared areas. The steep phase of Cattaraugus gravelly loam is a shallow soil with many rock outcrops. Some areas having a silt loam texture are included. The few cleared areas are utilized almost exclusively for pasture. This is an inextensive soil in Steuben County.

IMPERFECTLY DRAINED UPLAND SOILS

The soils of this group, represented by the Mardin, Langford, and Hornell soils, account for a large proportion of the total land area of the county, and, because of their physical characteristics, have played an important part in its agricultural development. The important industry of the area covered by these soils is dairying, as crops which allow a development of the dairy industry are the only ones which can be grown with any degree of success. These crops are, in order of importance, hay (clover and timothy), oats, buckwheat, and corn for silage. Potatoes are grown to some extent, but they furnish only a small part of the farm income, except where these soils occur in close association with the Bath and Wooster soils.

These soils occupy upland areas with rolling or steep relief. Surface drainage in most places is good, but the compactness of the subsoil impedes the movement of water within the soil. The soils have weathered from a mantle of glacial till derived exclusively from the underlying Devonian shales and sandstones.

Large areas of these soils still remain in forest, the greater part of which is in the southern half of the county. Practically all the merchantable timber has been removed, and the remaining forest growth consists of second- and third-growth hard maple, birch, and hemlock, with some oak, hickory. and ash on the better-drained ridges.

Much abandonment of farm land has taken place on areas of these soils, especially in the more remote sections.

Mardin gravelly silt loam.—Mardin gravelly silt loam has an 8-inch surface soil consisting of mellow friable gray or grayish-brown gravelly silt loam. The gravel consists of many small angular fragments of shale and sandstone scattered over the surface and through the soil. The upper subsoil layer, to a depth of 18 inches, is yellowish-brown or pale-yellow silt loam which is slightly compact and mottled with yellow and brown in the lower part of the layer. Somewhat larger stone fragments than those in the surface soil are present in this layer. The next lower layer, extending to a depth of about 36 inches, is composed of hard compact gray light silt loam

mottled with yellow and brown. Below a depth of 36 inches the material is hard and compact greenish-gray or drab unweathered till, containing a high percentage of angular shale and sandstone fragments, some of which exceed 10 inches in diameter.

Mardin gravelly silt loam occurs in close association with the Lordstown and Fremont soils and in some respects represents an intermediate condition between the soils of these two series. The Mardin soil has a rolling or moderately steep surface relief, the steeper areas being separated from the less rugged as a steep phase. This soil occurs in the uplands and on the higher slopes.

The variations within this soil are not great, although in areas mapped in association with soils of the Bath series, the surface materials are inclined to be brown and the upper subsoil layer is deeper.

Soils of the Mardin series are widely distributed over the county and, with the exception of the Lordstown soils, account for a larger proportion of the total area mapped than the soils of any other series. Because of their large extent they have had an important influence on the agricultural development of Steuben County, especially in the southern half where dairying is the main industry. The Mardin soils, because of their physical characteristics, are better suited to such crops as hay, grain, and pasture.

Hay, the crop of greatest importance grown on Mardin gravelly silt loam, is mostly timothy, although clover can be grown with moderate success if the soil is limed. Oats and buckwheat rank next in importance, oats being used as a nurse crop for the new grass seeding and buckwheat being a cash crop. This soil is too heavy and too poorly drained for success with potatoes, except where it occurs in association with the Bath and Wooster soils. Such areas are somewhat superior to the soil in the southern part of the county. Silage corn can be grown on the more favorably situated areas.

Most of this soil in the northwestern part of the county has been cleared, but much of that in the southern half still remains in forest of second- and third-growth hard maple, hemlock, beech, and yellow birch. Many farms on this soil have been abandoned and are growing up to brush. Where seed trees have been left, white pine comes in rapidly.

The stony areas of Mardin gravelly silt loam have a lower agricultural value than the rest of the soil. The surface relief is not everywhere so favorable, and the large quantity of angular shale and sandstone fragments of fairly large size scattered over the surface accounts for the lower agricultural value of this land.

The stony areas have a profile similar to the typical gravelly silt loam in all important characteristics. The friable gray silt loam surface soil and the yellow slightly compact upper subsoil layer are similar. Although the stone fragments over most of the gravelly silt loam are small and do not materially interfere with cultivation, in the stony areas they are numerous enough and of sufficient size to hinder tillage operations. It is probable that many areas mapped as Mardin gravelly silt loam were, before removal of the surface stones, Mardin stony silt loam. This is evidenced by the numerous large piles of rocks and stone fences surrounding some of the fields.

The crop adaptations of the stony areas are similar to those of the typical soil, though the yields on the nonstony areas are somewhat higher. A greater percentage of the stony land has been abandoned.

Mardin gravelly silt loam, deep phase.—Occurring in association with Mardin gravelly silt loam are a few areas that have a distinctly deeper topsoil and upper subsoil layer but are similar in all other respects to typically developed Mardin gravelly silt loam. The surface soil of these areas is brown or grayish-brown gravelly silt loam, 8 inches thick. The next lower layer, or upper subsoil layer, extends to a depth ranging from 18 to 24 inches and is yellowish-brown somewhat gritty friable silt loam. The color is more intense in the upper part of the layer but fades to pale yellow at a depth of 20 inches. The lower subsoil layer is compact and moderately hard yellowish-gray or greenish-gray material which contains a large percentage of small angular fragments of fine-grained sandstone and is faintly mottled with rust brown and gray. Below a depth of 30 inches the material resembles typical Mardin gravelly silt loam in all characteristics.

Because of the greater depth to the hard compact material, the deep phase is superior to typical Mardin gravelly silt loam, but because of its small extent it is of little agricultural importance. The largest area lies northeast of the village of Avoca, in the town of Wheeler.

Crop adaptations are similar to those of Mardin gravelly silt loam, although the deep phase is a superior soil for potato production.

Mardin gravelly silt loam, steep phase.—The steep phase differs from typical Mardin gravelly silt loam mainly in topographic position, but the profile characteristics do not differ essentially from those of the typical soil. This soil occurs on slopes so steep as to seriously interfere with cultivation. Consequently, much of the land still remains in forest. Most of the cleared land is utilized as pasture, and the grass from some fields is cut for hay.

Mardin stony silt loam, steep phase.—The difference between this phase of Mardin stony silt loam and the stony areas of Mardin gravelly silt loam is mainly topographic, the steepness of the slopes prohibiting the efficient use of agricultural machinery. Practically all the land is in forest. The cleared areas are used only for pasture. Because of its low agricultural value and small extent, this is not an important soil.

Langford silt loam.—Langford silt loam closely resembles Mardin gravelly silt loam in the physical characteristics of the soil profile. The separation was based on the alkaline character of the subsoil of Langford silt loam, which has been inherited from the parent material derived from local shale and sandstone rocks. Apparently thin lenses of calcareous materials were laid down in these rocks and, owing to the action of glacial ice, became ground up and mixed with other debris, giving rise to calcareous material.

The 6- to 8-inch topsoil of Langford silt loam is brown or grayish-brown friable granular silt loam containing a fair quantity of small angular sandstone fragments. The upper subsoil layer, to a depth of 24 inches, is yellowish-brown slightly compact gravelly silt loam mottled in the lower part with gray and rust brown. The lower part of the subsoil, to a depth of 42 inches, is compact hard highly mottled

gritty silt loam containing many angular sandstone and shale fragments. Below this the material consists of hard compact gray or drab unweathered till.

Langford silt loam occurs on the rolling or steep uplands, the steeper areas being shown as a steep phase. Although this soil is mapped in small areas in all parts of the county, it is most widely distributed and shows its best development in the towns of Bath and Cameron, where it occurs in association with Erie, Lordstown, Mardin, and Fremont soils.

This soil produces good yields of the crops common to the upland parts of the county. Dairying is the important industry of the farms located on this soil. Hay, mainly timothy, is grown on a large proportion of the cultivated land. Clover can be grown with good results where the land has been limed. Oats, silage corn, and buckwheat are also grown. Potatoes are grown to some extent, but the acreage is not large. Langford silt loam, as a whole, is a more productive soil than Mardin gravelly silt loam, and this fact is reflected in the lower percentage of abandoned land occurring on the Langford soil.

Langford silt loam, steep phase.—The steep phase of Langford silt loam is very similar to the typical soil in all profile characteristics and was separated on the basis of surface relief only. It occurs on slopes so steep as to preclude the use of farm machinery. Land that is cleared is used almost exclusively for pasture. Surface drainage on this soil is excessive, and erosion has taken place on the cleared areas.

Hornell silty clay loam.—The 4-inch surface layer of Hornell silty clay loam consists of grayish-brown or yellowish-brown silty clay loam which is friable and somewhat granular in the virgin condition. Immediately beneath this layer and extending to a depth of 9 inches is yellowish-brown or pale-yellow compact and tight clay loam showing faint mottles of yellow, brown, and gray.

Under cultivation this soil puddles very easily, one of its characteristics being the extremely cloddy character of tilled fields. The upper subsoil layer, between depths of 9 and 18 inches, is very heavy clay moderately mottled with reddish brown and a few green spots. The red color predominates, giving the material a rust-colored appearance. This layer assumes a definite columnar structure and breaks out in long lumps. This structure is especially apparent in the dry soil, when wide vertical cracks appear. The lower subsoil layer, between depths of 18 and 30 inches, consists of partly weathered soft shale which is very heavy in texture and highly mottled with rust brown and greenish gray. The substratum is a soft dark shale.

Hornell silty clay loam has a rather limited distribution in the towns of Cameron, Canisteo, Howard, and Hornellsville, and it lies at comparatively high elevations. Its agricultural value is low, the heavy texture making the land hard to prepare and retarding the movement of water. It is better adapted to timothy hay than to any other crop, though oats and buckwheat can be grown.

This soil erodes readily because the heavy texture prevents the rapid absorption of moisture. Consequently much water is lost as surface run-off.

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A large proportion of the land has been abandoned. Some of the abandoned areas are reverting to forest, and others, where erosion is taking place, are completely devoid of vegetation.

Hornell silty clay loam, steep phase.—The steep phase of Hornell silty clay loam differs from the smoother areas only in the degree of slope, which in the steeper areas is great enough to materially reduce the value of the land for agriculture. Areas from which the forest has been removed seem to erode very readily, as evidenced by the numerous gullies present.

This soil has a very low agricultural value and has been almost entirely abandoned. A small acreage is utilized as pasture.

POORLY DRAINED UPLAND SOILS

The group of poorly drained upland soils includes some of the most widely distributed soils in the county, which, as regards the total area covered by them, are exceeded in importance only by the well-drained upland soils. The poorly drained soils occupy rolling, level, and sloping areas. This group is subdivided into deep and shallow soils. The soils of the first subgroup, including the Fremont, Volusia, and Erie soils, are derived from deposits of glacial-till material of different thicknesses. They comprise the locally known hardpan soils, although, in general, the hard layer is not so well developed in the Fremont soils and in places is lacking. The Fremont and Volusia soils are acid, and the Erie soils have alkaline subsoils or lower subsoil layers.

The subgroup of shallow poorly drained soils includes the Allis soils and a shallow phase of the Volusia soils. The Allis soils are derived from the weathering in place of the underlying shales. They are thin soils, bedrock in most places occurring within 30 inches of the surface. They are characterized by heavy textures and highly mottled subsoils. The shallow phase of the Volusia soil represents a thin mantle of glacial till overlying bedrock, in most places within 30 inches of the surface.

Fremont gravelly silt loam.—Fremont gravelly silt loam has an 8-inch surface soil consisting of gray or yellowish-gray friable silt loam or heavy silt loam. Many sandstone fragments are scattered over the surface and throughout the soil, a large percentage of which are small, giving the soil a gravelly character. The upper subsoil layer, between depths of 8 and 22 inches, is pale yellowish-gray silt loam mottled with rust brown and gray. The lower part of this layer is moderately compact. The lower subsoil layer, below a depth of 24 inches, is compact and moderately mottled with brown and yellow. The texture of this material ranges from gritty silt loam to silty clay loam. The mottled effect fades out at a depth of about 30 inches.

Fremont gravelly silt loam has weathered from a mantle of glacial till derived entirely from the local underlying rocks. These rocks, predominantly fine-grained and dense sandstones, have given rise to soils characteristically silty in character, with a strongly acid reaction.

Fremont gravelly silt loam occurs only at high elevations on the plateau top where it occupies level or moderately rolling areas in association with members of the Lordstown, Bath, and Mardin series.

It also occurs contiguous to areas of Volusia soils, but is everywhere at a higher elevation. The Fremont soils differ from those of the Volusia series in that the subsoils lack the hard indurated character typical of the Volusia soils. Drainage is better because the Fremont soils lie at higher elevations and are not subject to so much seepage water.

Fremont gravelly silt loam covers a large total acreage, and it occurs in all parts of the county. It has rather limited cropping abilities because of its unfavorable physical characteristics. The crops grown, in order of their importance, are hay (timothy and clover), oats, buckwheat, and silage corn. With such crops dairying is the principal agricultural industry.

Much of this land still remains in forest, especially in the southern part of the county. Many farms located on the Fremont soils have been abandoned and are reverting to a wild bushy condition.

Fremont gravelly silt loam, stony phase.—The stony phase of Fremont gravelly silt loam differs from the typical gravelly silt loam in the quantity and size of the surface stones which are sufficiently numerous to reduce the agricultural value of the land. Most areas of the stony soil occupy slight depressions. This is a soil of small extent and is used largely as pasture.

Fremont silt loam.—Fremont silt loam has an 8-inch surface soil of brown or olive-gray loose friable silt loam. The upper subsoil layer, extending to a depth of 18 inches, is heavy silt loam which is firm but not compact and is highly mottled with rust brown, gray, and yellow. The lower subsoil layer, to a depth of 30 inches, is dense and moderately compact, but not hard, heavy silt loam. The material in this layer is slightly mottled with yellow and brown in the upper part. The substratum consists of drab or greenish-gray compact and hard unweathered glacial till.

Fremont silt loam is superior to Fremont gravelly silt loam. The same crops are grown, but larger yields are obtained on the silt loam. It occurs at a slightly lower elevation than the gravelly soil and as a result is better adapted for the production of silage corn. Some potatoes also are grown.

Fremont silt loam is most widely developed in the northern part of the county in association with the Bath and Wooster soils.

Volusia gravelly silt loam.—The surface soil of Volusia gravelly silt loam, to a depth of 6 inches, consists of yellowish-gray silt loam or heavy silt loam, which on drying assumes a characteristic gray color. In places the surface material contains sufficient clay to puddle badly if worked when wet. The gravel in this soil is composed of angular fragments of shale and sandstone. The upper subsoil layer, to a depth of 10 or 12 inches, is heavy silt loam or silty clay loam, highly mottled with rust brown, yellow, and gray. The line of demarcation between the surface soil and subsoil is distinct. In many places the mottled material is turned up by the plow. The next lower layer, extending from a depth of 12 to a depth of 24 inches, is compact and tight silty clay loam mottled with gray and brown. The material in this layer is so hard and compact that it stops the free movement of water and is known locally as hardpan. The mottled appearance is more intense in the upper part of the layer and fades out at a depth of about 20 inches. The subsoil layer, below a

depth of 24 inches, consists of compact and hard very slightly weathered drab or gray glacial-till material containing a large number of angular stone fragments.

This soil has weathered from a mantle of glacial till derived entirely from the local underlying shales and sandstone. The soil material as a whole is deep, bedrock in few places occurring within 4 feet of the surface.

The surface relief of most areas is smooth. This soil occurs on long moderately gentle slopes, with a distinct increase in the degree of slope just above the areas of other Volusia soils. Seepage water from the higher lying soils usually reaches the surface at this break in the relief, and it is this seepage water that is responsible for the wet condition of the lower lying Volusia soil and the formation of the hardpan layer.

Volusia gravelly silt loam occurs in close association with members of the Mardin, Lordstown, and Fremont series. It resembles the Fremont soils rather closely in some respects and is distinguished from those soils mainly as regards relief and by the fact that the hardpan layer, which is so strikingly developed in the Volusia soils, is lacking or only moderately developed in the Fremont soils.

The agricultural value of Volusia gravelly silt loam is low. Poor internal drainage and unfavorable physical characteristics reduce crop yields to a minimum.

Timothy hay is the most important crop grown, followed by buckwheat and oats, and corn for silage is grown to some extent. Where the Volusia soils are utilized to any extent, dairying is the only agricultural industry, and buckwheat is the only cash crop grown. A large proportion of the total acreage is abandoned land which is reverting to forest.

Volusia gravelly silt loam, stony phase.—The stony phase of Volusia gravelly silt loam is of very small extent and is of even lower agricultural value than the typical gravelly silt loam, from which it differs only in the quantity of stones on the surface. The stony phase contains large numbers of angular shale and sandstone fragments ranging in size from gravel to stones 10 or 12 inches in diameter. Not only are the stones scattered over the surface, but they are present throughout the soil. The gray surface soil, mottled subsoil, and hardpan development are similar to the corresponding layers of typical gravelly silt loam. Very little of this stony soil is cultivated. Most of the land which has not been abandoned is used for pasture land.

Volusia silt loam.—Volusia silt loam does not differ materially from Volusia gravelly silt loam, except in the smaller quantity of stone fragments present. The surface soil is heavy smooth grayish-yellow silt loam underlain by heavier highly mottled silty clay loam. The subsoil has the same hard compact structure typical of Volusia gravelly silt loam.

Volusia silt loam occurs on moderately sloping areas with a smooth surface relief, in association with the Fremont, Mardin, and other Volusia soils. It has the same agricultural value as Volusia gravelly silt loam, but it is not so extensive.

Volusia silt loam, dark-colored phase.—The 8-inch topsoil of Volusia silt loam, dark-colored phase, is gray or dark-gray heavy

silt loam rather high in organic matter, from which it derives the dark color. In cultivated fields the soil puddles and in most places has a cloddy surface soil. The surface soil is underlain abruptly by highly mottled tight sticky heavy silt loam which is impervious to water. The base material is yellowish gray, and the mottles are rust-brown, yellow, and gray blotches. The lower subsoil layer is composed of drab or yellowish-gray hard compact silty clay loam containing an appreciable quantity of sandstone fragments.

Most areas of this phase occur as narrow belts at the bases of steep slopes where seepage water comes to the surface. The soil is distinctly wetter than either the gravelly silt loam or the typical silt loam, and most of it is water-logged during the greater part of the summer. Soil of this phase is small in extent and is seldom cultivated. Some areas are used as pasture.

Volusia silt loam, shallow phase.—The surface soil of the shallow phase of Volusia silt loam is brown or brownish-gray friable and somewhat granular silt loam. Scattered over the surface and throughout the soil are numerous thin angular fragments of fine-grained sandstone, ranging in size from gravel to pieces 14 inches in diameter. The upper subsoil layer, between depths of 8 and 13 inches, consists of yellowish-brown somewhat tough and plastic gritty silt loam. The material in this layer is moderately mottled with brown, yellow, and gray. It is dense and compact but not hard. From a depth of 13 inches to a depth of 26 inches, the material is extremely plastic and tough heavy silty clay loam, highly mottled with gray, yellow, and rust brown. In most places, bedrock occurs at a depth of 36 inches, but in spots it lies within 24 inches of the surface.

The shallow phase of Volusia silt loam has been derived from a thin mantle of glacial till composed entirely of decomposed material from the local underlying shales and sandstones. It occurs on level or gently sloping areas and on the flat tops of some ridges. It is most extensively developed in the towns of Urbana and Bradford, in the eastern part of the county, and in the town of Cameron in the central part. In common with other Volusia soils it has a low agricultural value.

Dairying is followed to some extent on areas of this soil, and hay, oats, and buckwheat are the most important crops grown. A large proportion of the total area has been abandoned and is growing up to brush.

Erie gravelly silt loam.—The 8- to 10-inch surface soil of Erie gravelly silt loam consists of gray moderately loose and friable gritty silt loam with many angular sandstone fragments scattered over the surface and throughout the soil. Below this layer and extending to a depth of about 20 inches the material is gray gritty silt loam mottled with brown and yellow blotches. The material in the upper part of this layer is only moderately compact, but at a depth of 20 inches it is very hard and dense. The texture also becomes heavier with depth. The lower subsoil layer, to a depth of 36 inches, is tight, compact, tough, gritty silty clay loam, slightly mottled with yellow and brown. Below a depth of 36 inches the material is largely unweathered gray or drab hard glacial till containing a high proportion of sandstone and shale fragments having a maximum diameter of 8 inches.

The characteristic feature of this soil, and the one distinguishing it from the Volusia soils, is the alkaline character of the subsoil which in many places contains enough free lime to effervesce with dilute hydrochloric acid. The depth at which the material becomes alkaline ranges from 1 to 4 feet. The "sweet" subsoil of Erie gravelly silt loam makes it a better soil than the Volusia soils, especially for producing pasture grasses. No hardpan is developed close to the surface in the Erie soils as in the Volusia soils, and the surface soil may be somewhat deeper and more friable.

Erie gravelly silt loam occupies the more level and moderately rolling uplands. It is typically developed north of the village of Prattsburg and eastward from this place to Keuka Lake. Fair-sized areas are mapped on the upland both north and south of Canisteo River, in the central part of the county. Here the subsoil is distinctly more yellow than in the areas near Prattsburg.

The Erie soils have formed from the weathering of glacial-till deposits derived from the local shale and sandstone rocks. The calcareous character of the subsoil is inherited from this shale and sandstone and is not caused by lime-bearing material transported from another region. It is difficult to explain why areas of calcareous material should be surrounded by the acid Volusia soils, but the fact that such material exists is noticeable in its effect on the vegetation growing on the soils. The mapped boundaries between the Erie soils and the noncalcareous soils are arbitrary in some places, owing to the irregularity of the areas in which the calcareous material occurs and to the inadequacy of the methods used in testing the soils in the field.

The physical characteristics of Erie gravelly silt loam limit its agricultural use to a few crops. Where cultivated, timothy, oats, and buckwheat are the main crops grown. The soil is too heavy and too poorly drained for potatoes, and for the same reason it is not a good clover soil. Because the downward movement of water is retarded by the heavy compact subsoil the land dries out slowly in the spring.

Nearly all the Erie gravelly silt loam has been cleared of timber, probably because the surface relief is favorable for farming operations, but a large proportion of the land has been abandoned.

A few areas contain sufficient angular sandstone and shale fragments of a size large enough to be classed as stones.

Allis silty clay loam.—Allis silty clay loam has a 6- to 10-inch surface soil of light-brown, yellowish-brown, or gray-brown heavy silt loam or silty clay loam, which under cultivation tends to lump and puddle, especially in the areas of heavier texture. The lighter textured soil is fairly friable and mellow. The upper subsoil layer, to a depth of about 22 inches, is compact, tight, and plastic (when moist) silty clay loam or clay loam, the compactness and heavy texture increasing with depth. This material is highly mottled with gray, yellow, and rust brown. Below a depth of 22 inches the material consists of practically unweathered shale which is heavy in texture, dense, and highly mottled. The substratum of unweathered shale occurs in most places at a depth of about 30 inches.

Most areas of this soil have a level or flat surface relief, as a result of which natural drainage is poor. As water cannot pass downward, the soil is usually wet until late in the spring.

The Allis soils were formed from the weathering in place of the underlying shales, although in some places there may have been a very thin mantle of glacial drift.

Because it is thin, poorly drained, and strongly acid, this soil has a low agricultural value. A large proportion of the total area is abandoned land. Where utilized for crops, some timothy and buckwheat are grown, but the soil is better adapted to pasture than to any other use. This is an inextensive and unimportant agricultural soil in Steuben County.

Allis gravelly silt loam.—The surface soil of Allis gravelly silt loam is light-brown, yellowish-brown, or grayish-brown gravelly silt loam from 6 to 8 inches thick. The upper subsoil layer, to a depth ranging from 18 to 24 inches, is gray, mottled with yellow and rust-brown, heavy compact silty clay loam. In most places shale bedrock occurs within a depth of 3 feet. The content of shale fragments on the surface and throughout the soil is large.

This soil has the same agricultural value and crop adaptations as Allis silty clay loam. It is used largely as pasture land.

Allis gravelly silt loam, steep phase.—The steep phase of Allis gravelly silt loam differs little from the typical gravelly silt loam, except in the degree of slope. Soil of the steep phase has a lower value. The land is too steep to cultivate and is subject to extensive erosion.

PERMANENTLY WET SOILS

The group of permanently wet soils includes the Chippewa and Norwich soils, which are of little agricultural importance. Some of the less wet areas are utilized for pasture, but the largest acreage is waste land and still supports a forest growth of second- and third-growth softwoods.

These soils occur in low areas, depressions, and at the sources of streams. They are characterized by dark surface soils, high in organic matter, and by compact highly mottled subsoils. The Norwich soils, which occur only in the southwestern corner of the county, are distinguished from the Chippewa soils by their red color.

The texture of the surface soils of the members of both series is variable. Although these soils are classed a silty clay loam, some areas of silt loam and even loam occur. Most of the areas are gravelly or stony. Included in the Chippewa soils as mapped are small patches of shallow muck underlain by heavy green or blue clay.

Chippewa gravelly silty clay loam.—The surface soil of Chippewa gravelly silty clay loam is gray, dark-gray, or black silt loam or silty clay loam, extending to a depth of 8 inches. It is underlain by drab or gray highly mottled silty clay loam which extends to a depth of 24 inches. The mottling is rust brown, yellow, and light gray. The lower part of this layer is compact and hard. The lower subsoil layer is gray, compact, tight silty clay loam which is somewhat mottled, but the mottling is not so intense as in the layer above. Scattered over the surface and throughout the soil are various quantities

of sandstone fragments, some of which exceed 10 inches in diameter. Where typically developed this soil is acid throughout, but a few acres in the northern part of the county, which show an alkaline reaction, are included in mapping.

Chippewa gravelly silty clay loam occupies depressions, in association with Volusia, Fremont, and Mardin soils. It also occurs at heads of draws and watercourses and along small streams.

Norwich gravelly silty clay loam.—Norwich gravelly silty clay loam bears the same relation to the Cattaraugus soils that the Chippewa soil bears to the Volusia, Fremont, Mardin, and other upland soils. Norwich gravelly silty clay loam is a wet soil occurring in depressions. It is a red soil and occurs in association with the better drained soils of the same color. The 6- to 8-inch surface soil is composed of dark grayish-brown, or decidedly pink in places, gravelly silt loam or silty clay loam. Many sandstone fragments, some of which are large enough to be classed as boulders, occur on the surface and throughout the soil. The upper subsoil layer is mottled compact heavy silt loam which ranges from dark reddish brown to pink in color and extends to a depth of about 24 inches. Below this depth the material is tight, compact, heavy silty clay highly mottled with rust brown and gray. In some places bedrock lies within 4 feet of the surface.

This soil has little agricultural value except as pasture. Much of the land still remains in forest. It is strongly acid throughout.

VALLEY SOILS

The soils of the valley group are variable in texture, drainage, and color, owing in no small measure to the great variety of materials from which they have developed and to the different processes by which the materials were accumulated.

Owing to their diverse origin, development, and drainage, the valley soils are widely different in their value and use for different crops and under different farming methods. These soils, based on their agricultural relationships, may be divided into the following subgroups: Well-drained valley soils developed from materials deposited by glacial ice as glacial till, which include the Wooster and Lansing soils; well-drained valley soils developed from materials accumulated as lake-laid sediments, outwash, or morainic deposits, including the Chenango, Howard, Dunkirk, Groton, Otisville, and Arkport soils; well-drained alluvial soils, including the Chagrin and Tioga soils; imperfectly drained valley soils, including the Caneadea, Middlebury, and Eel soils; and poorly drained valley soils, including the Wayland and Holly soils.

WELL-DRAINED VALLEY SOILS FROM ICE-LAID DEPOSITS

The well-drained valley soils derived from ice-laid deposits occupy an important place among the agricultural soils of the county. This subgroup includes the soils of two series, the Wooster and Lansing. The soils of the Lansing series are of small extent, but the Wooster soils are extensively developed, especially in the northern and northwestern parts of the county. It is on the Wooster and Bath soils that the extensive potato-growing industry has developed, as the

medium textures, friableness, and deep, well-drained character of the Wooster soils render them ideally adapted for potato production. Not only potatoes but all other staple crops of the county are grown with excellent results.

Many of the more prosperous farms are located on the Wooster soils, and the buildings are in a better state of repair than on farms on many other soils. A low proportion of abandoned land reflects the agricultural value of these soils.

Wooster gravelly silt loam.—The 8-inch surface soil of Wooster gravelly silt loam consists of brown, yellowish-brown, or grayish-brown friable gravelly silt loam. The upper subsoil layer, to a depth of about 26 inches, is brownish-yellow or greenish-yellow gravelly silt loam or loam, which is friable and loose. The lower subsoil layer is open and loose and is slightly heavier in texture than the material above. The substratum to a great depth differs from the lower subsoil layer only in the degree of compaction, which increases with depth.

The gravel in this soil consists of water-worn and angular fragments of shale and sandstone, with different quantities of igneous material. The gravel is composed predominantly of small fragments, although many pieces are as much as 8 inches in diameter. The size of the stone fragments increases with depth, the substratum being stony rather than gravelly. In areas mapped in close association with soils of the Bath series, all the gravel is composed of angular shale and sandstone fragments.

The materials from which the soil has been derived are acid, therefore typically developed Wooster gravelly silt loam is acid throughout. This soil is one that has been formed from the weathering of deep deposits of glacial-till material consisting largely of decomposed material from the underlying rocks of the region, though various amounts of crystalline materials may be present.

Typically developed Wooster gravelly silt loam in Steuben County occurs on the lower slopes immediately above the valley floor and in the valley proper on morainic deposits. The largest areas are in the towns of Cohocton, Wayland, Dansville, and Fremont. This is probably the best agricultural section of the county and is the section where most of the potatoes are produced. Elsewhere, the soil occurs as narrow strips along the lower slopes and as small isolated patches.

Where typically developed, Wooster gravelly silt loam occurs on areas with rolling or sloping surface relief. The broken and strongly dissected areas have been separated as a steep phase.

Originally this soil was covered with a forest of hardwoods and softwoods, but, owing to favorable soil and topographic conditions, the land was rapidly cleared and brought under cultivation. The only remaining forests are scattered wood lots composed of second- and third-growth hardwoods.

The Wooster soils, because of their excellent physical characteristics and fairly wide distribution, rank among the best crop soils in the county. Dairying and potato growing are the important industries on these soils, and higher potato yields are obtained than on any other soils. Timothy and clover, oats, corn, and buckwheat are other important crops. Alfalfa is grown only now and then,

although good success with this crop is possible when the soils are limed, as all of them are acid.

Wooster gravelly silt loam, steep phase.—The important difference between Wooster gravelly silt loam and its steep phase is in surface relief. The steep phase occurs on slopes steep enough to reduce the agricultural value of the land, and the surface relief is rolling or rough. The soil is thinner, somewhat lighter in color, and contains less organic matter than the typical soil. It is subject to washing, and the cleared areas are gullied in places. A large acreage of the steep land remains in forest, but where the land has been cleared, it is used mostly for pasture, though the more favorably located areas may be cultivated. The steep phase is of little importance agriculturally, because of its small extent.

Wooster gravelly loam.—Wooster gravelly loam has a 10-inch surface soil consisting of grayish-brown and yellowish-brown loose friable gravelly loam. The upper subsoil layer is composed of pale-yellow open and friable gritty fine sandy loam, extending to a depth of about 24 inches. The lower subsoil layer is yellow gritty fine sandy loam which is somewhat compact and hard. This material extends to a great depth with no apparent change except in the degree of compaction, which increases with depth.

The gravel in this soil consists of angular and water-worn fragments of shale and sandstone, together with an appreciable quantity of igneous erratics. The surface soil contains a large quantity of this gravel, especially the igneous materials. The amount of angular material is greater in the lower subsoil layer, where pieces 8 or 10 inches in diameter are common.

Wooster gravelly loam has weathered from similar materials and was deposited in the same manner as Wooster gravelly silt loam and like that soil is acid throughout. The two soils do not differ essentially in either topographic position or surface relief. Wooster gravelly loam is mapped almost exclusively in the towns of Cohocton, Dansville, Wayland, and Fremont, where it occurs in association with other Wooster soils and soils of the Arkport and Fremont series. It is an excellent agricultural soil, differing little from Wooster gravelly silt loam in cropping characteristics.

Wooster gravelly loam, steep phase.—The steep phase of Wooster gravelly loam is not important as an agricultural soil mainly because of its small extent. Its profile characteristics are similar to those of the typical gravelly loam, from which it differs only in topographic position and surface relief.

Wooster stony silt loam.—Wooster stony silt loam has a surface soil 8 or 10 inches thick, consisting of yellowish-brown or yellow gritty friable silt loam. Scattered over the surface and throughout the soil are numerous angular fragments of shale and sandstone, many of which attain a size of 8 or 10 inches in diameter. The next lower layer, extending to a depth of 24 inches, is pale-yellow gritty loose and open gravelly loam or light silt loam. The lower subsoil layer is only moderately compact to a depth ranging from 36 to 48 inches, below which the compaction increases with depth. This layer of the subsoil is pale yellow with a somewhat green cast, and the material has a gritty loam texture. The content of stone fragments is somewhat greater in the lower subsoil layer than in the layers above, and the individual fragments average larger.

Wooster stony silt loam has been derived from deep deposits of glacial-till material consisting of material derived from the decomposed local shale and sandstone bedrock. This soil differs from Wooster gravelly silt loam and Wooster gravelly loam in that it contains very little, if any, water-worn gravel or igneous erratics. It resembles these two soils in that it is well drained in both the surface soil and subsoil and is acid throughout the soil and the substratum.

Wooster stony silt loam occurs predominantly on slopes, though in places it occupies the tops of low ridges. The surface relief ranges from smooth to rolling. This soil occurs in association with the Fremont, Mardin, and Lordstown soils, and also in association with other Wooster soils. It is not so important agriculturally as Wooster gravelly silt loam and Wooster gravelly loam, as it lacks the inherent fertility of these two soils and does not respond so readily to fertilization and good tillage.

Dairying is the leading industry on farms located on Wooster stony silt loam. Hay, oats, buckwheat, and potatoes are the important crops grown. Much of the land remains in forest of second- and third-growth hardwoods. More of the stony silt loam has been abandoned than of the other Wooster soils.

Wooster stony silt loam, steep phase.—The steep phase of Wooster stony silt loam is a soil of small extent and low agricultural value. It differs from the typical stony silt loam only in the degree of slope, which in the steep phase is so great as to prohibit the use of farm machinery. The few cleared areas are used almost exclusively for pasture.

Wooster silt loam, calcareous phase.—Occurring in association with the Wooster soils, which are acid in reaction where typically developed, are areas with a neutral or alkaline subsoil. Such areas, because of their small extent and because in all other characteristics they resemble true Wooster soils, have been designated as Wooster silt loam, calcareous phase.

The largest and most important area is in the town of Dansville north of the village of Arkport. The soil also occurs in small scattered patches along the Canisteo Valley.

This is a good agricultural soil, adapted to the same crops and producing as high yields as Wooster gravelly loam and Wooster gravelly silt loam. Because of the alkaline subsoil, the soil is especially well adapted to alfalfa, although at present very little is grown.

Lansing gravelly silt loam.—The 8-inch surface soil of Lansing gravelly silt loam consists of brown or grayish-brown friable granular silt loam containing many angular shale fragments and rounded gravel. The upper subsoil layer, to a depth of about 15 inches, is yellowish-gray or light-yellow gritty silt loam which is distinctly more compact than the surface soil and contains many fine shale fragments. The lower subsoil layer is yellowish-brown or drab gritty silt loam faintly mottled with brown and yellow. The material in this layer is moderately hard and compact in place, but it crushes readily when broken out in lumps. An appreciable quantity of fine gravel, consisting of both rounded pebbles and dark thin shale fragments, occurs throughout this layer. The substratum is hard compact heavy silt loam, ranging from somewhat green to drab in color.

The surface soil is acid in reaction, but the subsoil is alkaline, in many places containing enough lime to effervesce with dilute hydrochloric acid. The occurrence of the lime differs from place to place. In some places it is close to the surface, and in other spots it is absent or is present only in the lower part of the subsoil. This calcareous character has been inherited from the parent material.

Lansing gravelly silt loam has weathered from a mantle of glacial till derived from the local underlying rocks which consist of black thin-bedded shales, with here and there lenses of sandstone. This soil is confined to a rather narrow belt bordering Keuka Lake Valley and Keuka Lake. The surface relief is characterized by slopes ranging from moderate to steep, and in some places the land is badly gullied. This is an unimportant soil in the county, because of its small extent. The most important crop produced on it is grapes. Areas so steep that they would be classed as nonagricultural in other parts of the county are utilized along Keuka Lake for vineyards. The more favorably located areas produce good crops of hay, oats, buckwheat, and forage crops.

WELL-DRAINED VALLEY SOILS FROM OLD WATER-LAID DEPOSITS

This group of soils includes the acid Chenango and Otisville soils and the alkaline Howard, Dunkirk, Arkport, and Groton soils, the most important agricultural soils in the valleys. Favorable soil characteristics and favorable surface relief have allowed the development of a successful diversified type of agriculture. These soils, with the exception of the Dunkirk and Arkport, are characterized by brown friable gravelly surface soils underlain by stratified deposits of sand and gravel.

The Dunkirk soils have weathered from stratified deposits of silts and clays laid down in still water. They are characterized by gravel-free brown silty surface soils underlain by heavier textured, more compact subsoils. The Arkport soils are closely allied to the Dunkirk soils, differing only in texture of the surface soil material which, in the Arkport soils, is composed of sands and silts rather than silts and clays.

The materials from which these well-drained soils have weathered are derived largely from local shales and sandstones, together with a variable content of foreign materials of both crystalline and calcareous character.

Chenango gravelly silt loam.—The 10-inch topsoil of Chenango gravelly silt loam is brown, light-brown, or grayish-brown friable loose moderately granular gravelly silt loam well supplied with organic matter. The upper subsoil layer is yellowish-brown or yellow gritty silt loam which is slightly compact and contains only a moderate amount of gravel. This layer varies in thickness, extending from a depth of 10 inches to a depth ranging from 20 to 30 inches. Underlying this is a layer of dark-brown or coffee-brown gravel and sand, which is somewhat plastic when moist, with the interstitial spaces filled with coarse sandy material. The lower limit of this material is uneven, irregular tongues running down to a depth of 4 feet. The substratum consists of sand and gravel usually stratified at the lower depths.

Some variations occur within the Chenango soils, but the soils as a whole are essentially similar in regard to their layered arrangement and the composition of their soil material. Throughout the Cohocton Valley and in the northern and western parts of the county, a fair proportion of the gravel below a depth ranging from 6 to 8 feet is composed of limestone.[1] This material was brought in from the north and is present only in the valleys of the southward-flowing streams. The layer of rich-brown gravel and sand is absent in the Chenango soils mapped along Canisteo and Tioga Rivers, and the yellow subsurface soil is not so strikingly developed.

Streams emerging from hills form characteristic deposits which are similar to terraces in their layered arrangement and material. These alluvial fans have been included with Chenango gravelly silt loam, although the gravel is more angular and shows less stratification than that in typically developed Chenango soils. The soil of the fans is also lighter textured at the upper extremities, the fine material having been carried farther down into the main valley.

Chenango gravelly silt loam is one of the more important crop soils in Steuben County and has greatly influenced the agricultural development. It is very productive, and, as it occurs in the valleys, has the advantage of favorable climatic conditions. The good drainage, smooth surface relief, and the ease with which the land can be prepared, makes it adapted to all crops commonly grown in the county.

The most important crops are corn, beans, clover, alfalfa, and potatoes. Practically all the beans grown in the county are grown on the Chenango soils. Alfalfa grows well even though the soil is acid. The roots of alfalfa are probably able to reach the lime, where it occurs at a depth of about 6 feet below the surface. Potatoes are well adapted to this soil, but they are not grown to the extent they are on the Wooster and Bath soils, possibly because blight is more prevalent in the valleys.

Chenango silt loam.—Chenango silt loam, although not extensive, is probably the best soil of the Chenango series in Steuben County. The color and general soil characteristics are similar to those of the other Chenango soils, particularly Chenango gravelly silt loam. It differs from this soil mainly in that it has a comparatively gravel-free upper soil and averages 3 feet to bedded gravel, whereas in the other Chenango soils, bedded gravel averages 1 foot closer to the surface.

This soil occurs on the terraces of Chemung River near Corning The excellent structure of the soil, together with the greater depth to gravel, makes it more retentive of moisture than the other Chenango soils. Besides the crops commonly grown on the Chenango soils, this soil is successfully used for tobacco.

Chenango gravelly loam.—The topsoil of Chenango gravelly loam, to a depth of about 8 inches, is dark-brown gravelly loam rather high in organic matter and moderately granular. This layer contains a high percentage of rounded gravel, ranging up to 2 inches in diameter, composed mostly of shale and sandstone, with an occasional crystalline rock. The upper subsoil layer, extending to a

[1] The Chenango soils which contain lime material in the substratum are not typical.

depth of 20 inches, is brownish-yellow or yellow slightly compact gravelly silt loam or loam. This layer is composed mostly of small gravel with the interstitial spaces filled with the finer material. The lower subsoil layer, between depths of 20 and 48 inches, is grayish-yellow gravelly loamy sand which is very loose and open, with streaks and tongues of the yellow upper subsoil layer penetrating it to different depths. The material underlying this layer is loose porous unassorted gray or drab sand and gravel, which may be stratified in places above a depth of 6 feet and is everywhere stratified below this depth.

Areas of this soil are level or slightly rolling and in a few places occupy some gentle slopes. The soil occurs mainly in the northwestern part of the county.

The crops grown, yields, and utilization of this soil are essentially the same as on Chenango gravelly silt loam, with possibly a somewhat larger acreage of potatoes being grown on the gravelly loam. These two soils are the principal agricultural soils of the Chenango series in the county, both as regards productivity and extent.

Chenango loam.—The 8-inch surface soil of Chenango loam is light-brown, yellowish-brown, and in places grayish-brown friable and loose loam or gravelly loam. The upper subsoil layer, to a depth of 15 or 18 inches, is yellowish-brown or yellow gravelly loam which is slightly more compact than the surface soil but still friable. The lower subsoil layer is composed of brownish-gray or gray partly weathered stratified deposits of sand and gravel.

This soil consists primarily of outwash and alluvial-fan deposits and may have a rather large quantity of angular stone fragments scattered over the surface and throughout the soil. The material is porous and open, and crops are inclined to suffer from lack of moisture during dry seasons. Chenango loam is inferior in productive capacity to most of the other Chenango soils. It occurs only in the southern part of the county.

Chenango fine sandy loam.—Chenango fine sandy loam is very similar to Chenango gravelly loam and Chenango gravelly silt loam, differing only in two minor characteristics. The surface soil of Chenango fine sandy loam contains less gravel than either of the other two soils, and the texture is somewhat lighter, but the upper subsoil layer and the gravel substratum are similar. The agricultural use of the three soils is similar. Chenango fine sandy loam is a soil of small extent and is not very widely distributed. It occurs mainly in small scattered areas in the southern part of the county along Canisteo River and Tuscarora Creek.

Chenango very fine sandy loam.—Chenango very fine sandy loam is essentially the same as Chenango fine sandy loam. The surface soil contains only a small quantity of gravel and has a somewhat heavier texture, verging on a loam. In profile characteristics, agricultural value, and crop adaptations the two soils are identical. The very fine sandy loam occurs in a large area just south of Arkport and in a smaller area east of Wayland.

Chenango gravelly sandy loam.—The surface soil of Chenango gravelly sandy loam, which averages about 8 inches in thickness, is brown or grayish-brown loose and friable gravelly sandy loam. The material, between depths of 8 and 20 inches, is pale-yellow or

yellowish-gray loose porous gravelly sandy loam overlying drab or gray unassorted gravel and sand. The gravel is composed of both water-worn and angular material. Unlike Chenango gravelly silt loam and Chenango gravelly loam, the substratum is entirely free of limestone material.

Small areas of Chenango gravelly fine sandy loam are included with this soil as mapped. The distinctive feature of these areas is the high content of large gravel scattered over the surface, some of which are 3 or 4 inches in diameter. These cobblestones occur in sufficient quantities to interfere with cultivation, and they tend to accentuate a droughty condition characteristic of this soil during seasons of low rainfall.

Chenango gravelly sandy loam occupies level or gently sloping high terraces and occurs almost exclusively along Canisteo River. It is not so good a soil as the Chenango soils previously described, being somewhat too loose and open, which contributes to a droughty condition during dry seasons, but it produces good crops of fodder corn, beans, and, when limed, a good growth of alfalfa.

Howard gravelly silt loam.—The surface soil of Howard gravelly silt loam consists of a layer of brown, grayish-brown, or dark-brown friable mellow gravelly silt loam about 8 inches thick. The upper subsoil layer, extending to a depth of 18 inches, is yellow or yellowish-brown gritty silt loam which is more compact than the surface soil and contains a smaller quantity of gravel. The next lower layer, which is variable in thickness, but, where typically developed, extends to a depth of 36 inches, is a reddish-brown or buff mixture of silt, sand, and gravel, which is distinctly plastic when moist. The lower subsoil layer consists of stratified sand and gravel beds, with some stones of cobble size. In all places lime is present immediately below the reddish-brown plastic layer, and in areas lacking such a layer lime usually occurs in the upper subsoil layer. A large proportion of the material composing the stratified beds of gravel and sand occurring at the lower depths is limestone, and the remainder is shale and sandstone, together with a small quantity of crystalline material. The limestone has all been washed out of the surface soil and upper subsoil layers, leaving the shale and sandstone material.

Howard gravelly silt loam is developed most extensively throughout the Cohocton Valley and near Howard. It occurs in association with the Groton soils, from which it differs mainly in surface configuration. The area mapped near Howard is the largest single body of this soil in the county and represents an old delta deposit formed during glacial times. Besides this method of deposition, the Howard soils were formed as terraces and outwash plains. It is somewhat difficult to separate these soils from the Chenango soils, as the only distinction between them is based on the depth at which calcareous material appears.

The surface relief of Howard gravelly silt loam is flat, slightly undulating, or rolling, and this, together with its characteristics as a soil, makes it one of the best agricultural soils of the county. It is especially well adapted to the production of alfalfa. The most important crops grown are beans, alfalfa, silage corn, and potatoes.

Some variations may occur within this soil. The reddish-brown plastic layer may be only faintly developed or entirely lacking. This

particular characteristic is most strikingly shown in the large area east of Howard and is absent from the areas mapped throughout Cohocton Valley.

Howard gravelly loam.—Howard gravelly loam, with the exception of the texture of the surface layer, which is somewhat lighter, is identical with Howard gravelly silt loam. The materials from which it has been derived and the methods by which these materials were deposited are similar. It has the same crop adaptations and yields are as high as on Howard gravelly silt loam.

Howard gravelly loam occurs in close association with the Groton and Dunkirk soils. It is most extensive in the northern and northwestern parts of the county throughout the towns of Cohocton, Wayland, Dansville, and Fremont.

Howard fine sandy loam.—Howard fine sandy loam has a 6-inch topsoil of brown or grayish-brown fine sandy loam which is loose, friable, and granular, and contains only a small quantity of gravel. The upper subsoil layer, extending to a depth of 24 inches, is yellow loamy fine sand with an open porous character and a small content of fine gravel. The color of this layer grades from rust brown at a depth of 6 inches to pale yellow at a depth of 24 inches. Between depths of 24 and 36 inches the material consists of light-yellow compact and moderately hard very fine sandy loam. It changes at a depth of 36 inches to reddish-brown or buff gravelly loam which is compact, hard, and somewhat cemented by silty material. The material in this layer is decidedly plastic when moist. Below a depth of 48 inches are stratified beds of unweathered sand and gravel. Like Howard gravelly silt loam, much of the material at the lower depths is limestone.

In method of deposition, topographical position, surface relief, and agricultural adaptations, this soil is similar to Howard gravelly loam and Howard gravelly silt loam. It is not so widely distributed, however, occurring only north of Atlanta, adjacent to the county line, and southward from Wayland to Stephens Mills and Arkport.

Arkport fine sandy loam.—The surface soil of Arkport fine sandy loam consists of a 4- to 6-inch layer of grayish-brown loose friable moderately granular fine sandy loam. The upper subsoil layer, extending to a depth of 20 inches, is yellowish-brown slightly compact fine sandy loam containing a higher percentage of sand than the surface soil. Immediately below this layer is reddish-brown or dark-brown material which is heavier in texture and more compact than the surface soil, and is slightly plastic when moist. The depth of this layer is variable but where typically developed extends to about 3 feet. The substratum consists of light-gray or yellowish-gray fine sand containing a few rounded gravel and showing some lamination. Stratified beds of different-textured sands may be present in this soil at the lower depths.

The surface soil and upper subsoil layer are acid in reaction, but immediately beneath the reddish-brown layer free lime is present.

The Arkport soils have been derived from deposits laid down in shallow water. Erosion has rendered the surface relief rolling or irregular, though level or moderately undulating areas occur in places.

Arkport fine sandy loam ranks high as an agricultural soil. Timothy and clover, potatoes, corn, and oats are the most important crops grown. Because of the alkaline character of the subsoil, this soil is well adapted to alfalfa. During dry years the Arkport soils may be somewhat droughty because of their light texture, friability, and open structure.

This soil is not widely distributed. It occurs in the section extending south from Wayland to Hornell.

Arkport fine sandy loam, steep phase.—The steep phase of Arkport fine sandy loam represents a topographic condition rather than a soil difference. The badly eroded areas with steeply rolling or rough surface relief have been separated from the more level areas of Arkport fine sandy loam and designated as a steep phase. Aside from the loss of the surface soil, the profile characteristics are essentially the same as those of the other Arkport soils.

The agricultural value of the steep areas is low, as machinery cannot be used to advantage. The cultivated land tends to wash badly, consequently most of the cleared areas are used for pasture. Part of the land still remains in forest.

Arkport gravelly loam.—Arkport gravelly loam has a 6-inch surface soil consisting of grayish-brown friable loose gravelly loam underlain to a depth of 18 inches by yellowish-brown slightly hard and compact gravelly fine sandy loam or loam. The material in the next lower layer is reddish brown, gritty, and somewhat heavier in texture than the overlying material. The substratum is light-colored fine or medium sand having a laminated structure.

With the exception of a higher proportion of gravel in this soil, it has the same profile characteristics as Arkport fine sandy loam. The gravel is composed, predominantly, of fine water-worn fragments of shale and sandstone, and it contains a few limestone and crystalline pebbles.

This soil has the same surface relief as Arkport fine sandy loam, and its agricultural adaptations are similar.

Dunkirk silt loam.—The surface soil of Dunkirk silt loam, to a depth of 8 inches, consists of grayish-brown or brown loose friable silt loam containing a small quantity of fine gravel. Below this and extending to a depth of 18 inches, the material is yellow or yellowish-brown gritty silt loam which becomes somewhat compact in the lower part of the layer. The subsoil is reddish-brown silty clay loam which is only moderately compact and, on drying, tends to break into vertical columns. From a depth of 30 inches downward is reddish-brown or dark-brown compact and hard gritty silty clay loam which in most places contains enough free lime to effervesce with dilute hydrochloric acid. Stratified beds of fine sand, silt, and clay commonly occur at the lower depths of this soil.

The soil mapped as Dunkirk silt loam between Bath and Hammondsport differs somewhat from that described. It has been derived from lake-laid sediments, but, in general, the material is more drab or gray than typical Dunkirk silt loam. A few rounded gravel are scattered over the surface and throughout the soil. The surface soil is a good silt loam, but the subsoil carries a rather large percentage of fine sand and very fine sand. In method of deposition

layered arrangement, and agricultural adaptations, this variation is identical with the typical soil.

Dunkirk silt loam has a level or gently rolling surface relief. Originally it constituted smooth terraces, but erosion has removed much of the material, with a consequent change in surface configuration.

This soil produces good crops of timothy, clover, oats, and corn, but it is not adapted to the production of alfalfa. Because of the high water-holding capacity of the soil, heaving is likely to occur. On the areas between Bath and Hammondsport, large quantities of grapes are produced.

Dunkirk silt loam is a soil of small extent. Aside from the areas between Bath and Hammondsport, it occurs only in the northwestern corner of the county southwest of Wayland.

Dunkirk silt loam, rolling phase.—There is no essential difference between the profile characteristics of the rolling phase of Dunkirk silt loam and the typical soil, except that the surface soil of the rolling phase may be somewhat heavier in texture, approaching a silty clay loam. Land of the rolling phase has been so severely eroded that the surface relief is steeply rolling or rough, with deep narrow gullies. This characteristic precludes the possibility of cropping the land. Consequently, the cleared areas are utilized entirely as pasture. Land of this phase is unimportant agriculturally because of its small extent.

Groton gravelly loam.—The 8-inch surface soil of Groton gravelly loam is brown or grayish-brown gravelly loam. The upper subsoil layer, extending from a depth of 8 inches to a depth ranging from 24 to 30 inches is yellowish-brown or brown fine sandy loam containing a high percentage of fine gravel. The material in this layer is slightly more compact than the surface soil, but it is loose and friable. Below this layer the subsoil becomes a mass of loose calcareous sand and gravel. The gravel of the substratum is composed of rounded shale and sandstone fragments, in addition to a rather large quantity of limestone and a few crystalline fragments. In only a few places does the gravel occur in sufficient quantities to interfere with cultivation. Because of the loose porous character of the soil and the gravel substratum, drainage is excessive in many places.

This soil is not important agriculturally, because of its rough uneven surface relief and rather small extent, but good crops of potatoes, corn, clover, and beans are grown on the smoother areas. It is an excellent alfalfa soil, the loose porous character and calcareousness of the subsoil rendering the land ideally adapted to this crop.

Groton gravelly loam has weathered from materials deposited by water flowing from melting glaciers. The surface relief is characteristically of a kame and kettle character. The soil occurs in close association with the Wooster and Howard soils.

Groton fine sandy loam.—Groton fine sandy loam differs from Groton gravelly loam in having less gravel in the upper 3 feet of the soil. The surface soil is 6 or 8 inches thick and consists of brown or yellowish-brown fine sandy loam containing little, if any, gravel. It is underlain, to a depth of 18 inches, by material of the same texture but of rust-brown color. The material between depths of 18 and

36 inches is light yellowish-brown fine sand. Below a depth of 36 inches free lime is present. The substratum consists of stratified deposits of gravel and sand, much of which is limestone.

The surface relief and crop adaptations of Groton fine sandy loam are similar to those of Groton gravelly loam.

Otisville gravelly loam.—Otisville gravelly loam has an 8-inch surface soil consisting of grayish-brown loose open and friable gravelly loam. This is underlain to a depth of 20 inches by yellow gritty gravelly silt loam or loam which is more compact than the surface soil. The lower subsoil layer and substratum consist of mixed sand and gravel, showing stratification in the lower depths.

The gravel in this soil is composed chiefly of water-worn fragments of shale and sandstone, together with a few fragments of crystalline material. Limestone material is lacking to a depth ranging from 8 to 10 feet, but below this depth limestone may be present or the material may be sufficiently calcareous to react with dilute hydrochloric acid. The characteristic feature of Otisville gravelly loam, and that which distinguishes it from Groton gravelly loam, is the lack of limestone in the upper 8 feet. In all other respects the two soils are similar.

Otisville gravelly loam occupies morainic areas of a kame and kettle configuration, and most of the land is too rough to have much agricultural value except for pasture. Some of the smoother areas are cultivated, but only moderate crop yields are obtained. Beans, timothy, clover, and potatoes are the crops commonly grown. The soil, in general, because of its open porous character and excessive drainage, is too droughty for successful crop production.

Otisville gravelly loam, because of its small extent and low agricultural value, is of little agricultural importance in Steuben County. It occurs in association with the Groton and Wooster soils. The separation from the Groton soils is arbitrary in some places.

WELL-DRAINED ALLUVIAL SOILS

The well-drained alluvial soils are members of the Chagrin and Tioga series. Although subject to overflow they are rated as the most productive soils in the county. The Chagrin soils are alkaline from the surface downward, and the Tioga soils are acid. In other respects, such as method of deposition, surface relief, and topographic position, they are similar.

These are excellent soils, especially well adapted to timothy, clover, silage corn, tobacco, and small grains. Higher yields of these crops are obtained than on the soils of any other group. Dairying is the principal industry followed on farms located on these soils, and tobacco is grown almost exclusively on the Chagrin and Tioga soils.

Chagrin silt loam.—The surface soil of Chagrin silt loam, to a depth of 10 inches, is brown, grayish-brown, or dark-brown friable granular silt loam containing a good supply of organic matter. The upper subsoil layer, to a depth of 24 inches, is light-brown or yellowish-brown silt loam which is slightly compact and somewhat heavier in texture than the surface soil. The lower subsoil layer is light brown or grayish brown, is more compact than the layers above, and ranges in texture from sandy loam to silty clay. Where the material in this layer approaches silty clay in texture it is usually

mottled yellow and brown. The substratum consists of stratified beds of sand, silt, and gravel, the gravel occurring within 3 feet of the surface.

The texture of the surface material of Chagrin silt loam is somewhat variable. Spots having a fine sandy loam texture are rather widely distributed throughout this soil. Some areas contain rather large quantities of small water-worn gravel scattered over the surface and throughout the surface soil.

All the Chagrin soils have alkaline subsoils and in many places are alkaline from the surface down. In places they contain enough free lime to effervesce with dilute hydrochloric acid.

The Chagrin soils represent recent alluvial material deposited by streams, and they are being constantly added to when overflows occur. The surface relief is level or flat.

Chagrin silt loam is the most important and widely distributed Chagrin soil in the county. Where drainage is good this soil ranks high agriculturally. Excellent yields of hay, silage corn, and small grains are obtained. Alfalfa can be successfully grown. Where drainage is imperfect the soil furnishes excellent pasture. Most of the land has been cleared, although a few patches of second-growth forest occur.

Chagrin silt loam, high-bottom phase.—The high-bottom phase of Chagrin silt loam has a profile similar to that of typical Chagrin silt loam. It differs only in topographic position. Where typical Chagrin silt loam occupies a first-bottom position and is subject to overflow, the high-bottom phase occurs one level above the stream and is seldom, if ever, overflowed. The high-bottom phase is somewhat older than the typical silt loam. It formerly occupied a first-bottom position, but the streams have cut deeper and left it in a low-terrace position.

Soil of the high-bottom phase, as a whole, is probably better drained than the typical silt loam, but it is not so important agriculturally because of its small extent. It has a level or gently undulating surface relief and usually occurs in positions intermediate between the Chenango soils and typical Chagrin silt loam.

Chagrin silt loam, dark-colored phase.—The dark-colored phase of Chagrin silt loam is very small in extent. It differs from typical Chagrin silt loam mainly in the higher amount of organic matter present, which accounts for the darker color of the surface soil. In places the dark-colored soil is composed of a layer of mineral soil of different thicknesses, overlying organic deposits. Land of this kind is unimportant agriculturally and is utilized largely as pasture land.

Chagrin loam.—Chagrin loam occurs as narrow strips along the minor stream courses. It has a comparatively high water table and is subject to frequent overflow. It consists of a 20-inch layer of brown alkaline loam or gravelly loam, overlying sand and gravel.

This is a very inextensive soil occurring only in the northern part of the county. Because of its occurrence as narrow strips and the frequency of overflows, the land is used exclusively for pasture.

Tioga silt loam.—The 6-inch surface soil of Tioga silt loam consists of light-brown or dark-brown (when moist) friable silt loam. The upper subsoil layer, between depths of 6 and 18 inches, is yellowish-brown loose and mellow silt loam which is slightly compact in the

lower part. Between depths of 18 and 48 inches, the material is light-brown, grayish-brown, or brown slightly compact silt loam or silty clay loam, in places faintly mottled. Below a depth of 48 inches the material may consist of stratified beds of sand and gravel.

Tioga silt loam occurs along Tioga and Chemung Rivers and their tributaries in the southern and southeastern parts of the county. It is a good agricultural soil, producing excellent crops of timothy, clover, silage corn, small grains, and tobacco. Practically all the tobacco produced in the county is grown on this and other Tioga soils. The imperfectly drained areas are utilized as pasture.

In some places an appreciable quantity of gravel occurs over the surface and through the surface soil. These areas have not been separated as a distinct soil but are shown on the map by gravel symbols.

Tioga silt loam, high-bottom phase.—The high-bottom phase of Tioga silt loam represents an older soil condition than typical Tioga silt loam. The soil was deposited in the same manner and is composed of similar materials, but since the time it was laid down, the streams have cut deeper, forming a bottom at a lower level and leaving the former bottom land as a low terrace.

Profile characteristics are, in the main, similar, except that the high-bottom phase is entirely free of mottling in the lower part of the subsoil, indicating a better drained condition. The high-bottom phase is not subject to overflow and, on the whole, is somewhat superior to the typical soil. Areas of this soil are mapped along the Tioga and Chemung Rivers and other streams in the southern part of the county.

Tioga fine sandy loam.—Tioga fine sandy loam is essentially the same as Tioga silt loam, differing from that soil only in texture of the surface layer. The fine sandy loam occurs immediately adjacent to the stream channels and may be overflowed more frequently than the silt loam. Hence a greater proportion of the fine sandy loam is in pasture. Aside from this, the crop adaptations of the two soils are similar.

IMPERFECTLY DRAINED VALLEY SOILS

Imperfectly drained valley soils are represented by the Caneadea, Middlebury, and Eel soils. The Caneadea soils, occupying a terrace position, have little significance in the agriculture of the county because of their very small extent. The Middlebury and Eel soils are first-bottom soils, characterized by brown friable and granular surface soils underlain by material slightly heavier in texture and more compact. As first-bottom soils they are subject to overflow, but overflow occurs only at infrequent intervals and does not detract much from the agricultural value of these soils.

Caneadea silty clay loam.—The 10-inch surface soil of Caneadea silty clay loam is yellowish-brown or grayish-brown silty clay loam, with a few rounded gravel on the surface. In cultivated fields the surface soil is usually lumpy because of the heavy texture of the material. The lower part of this layer may have a more gray cast and be faintly mottled with yellow and brown. The upper subsoil layer, to a depth of about 20 inches, is compact tight clay loam with a gray cast, mottled with yellow and brown. The material, on drying, tends

to crack into vertical columns. The lower subsoil layer, ranging in depth from 20 to 60 inches, may be stratified beds of silt and clay, which are tight and dense and of a gray or cream color. In some places, more notably in the southwestern part of the county, this material may rest on glacial till at different depths. The lower part of the subsoil of Caneadea silty clay loam is alkaline and in many places contains enough free lime to effervesce with dilute hydrochloric acid.

Caneadea silty clay loam in Steuben County is very small in extent and is not important agriculturally. The heavy texture of the surface soil and subsoil makes the soil best adapted to hay and grain crops. Surface drainage is only fair, and the heavy dense subsoil impedes the downward movement of moisture.

Caneadea silt loam.—The 10-inch surface soil of Caneada silt loam is composed of friable and somewhat granular gray silt loam. Scattered over the surface are a few angular and rounded gravel. The upper subsoil layer, to a depth of about 22 inches, is hard and compact gritty silt loam having a drab base color mottled with yellow, rust brown, and gray. It contains a few angular and subangular stone fragments of both local and foreign materials. Between depths of 22 and 30 inches the material is less compact and hard, only slightly mottled, and somewhat lighter in texture. The lower subsoil layer, between depths of 30 and 48 inches, is cream-colored silt which is compact and dense and contains free lime. In some places, below a depth of 30 inches, the material consists of alternate layers of silt and clay.

A variation from the soil described occurs between Grove Springs and Keuka on the eastern shore of Keuka Lake. Here the surface soil may be gray-brown or red; the subsoil, between depths of 18 and 30 inches, is reddish-brown gritty silty clay loam, which is tight, compact, and slightly mottled in some places; and the lower part of the subsoil may be greenish-gray or drab gritty loam lacking the compaction of the layer above. Lime concretions occur in this layer in places. This material, like typical Caneadea silt loam, has been derived from lake-laid sediments, but it differs from the typical soil in color.

Caneadea silt loam is all under cultivation and is used mainly for hay, small grains, and pasture. This heavy-textured soil with imperfect drainage is practically limited to such crops. Caneadea silt loam along Keuka Lake is used to a small extent for vineyards. The soil is small in extent and not important agriculturally.

Middlebury silt loam.—The surface soil of Middlebury silt loam is light-brown or grayish-brown friable silt loam grading into yellowish-brown material of similar texture, which is faintly mottled with rust brown and yellow and shows some compaction. Between depths of 15 and 30 inches is tough, compact, and dense smooth silt loam, highly mottled with yellow, gray, and brown, underlain by reddish-brown, gray, and yellow mottled tightly compact silt loam which extends to a depth of about 40 inches. The substratum consists of gray loose sand and gravel, which are stratified in some places. The gravel is composed almost entirely of shale and sandstone, with an occasional crystalline erratic. This soil is acid to a depth exceeding 5 feet. Below this depth, part of the gravel may be composed of limestone.

This soil is essentially the same as Middlebury silt loam, high-bottom phase, in all characteristics of the soil profile. It differs only in the topographic position which it occupies. It is a first-bottom soil and as such is subject to flooding at irregular periods. Crop adaptations are similar to those of the high-bottom phase.

Typical Middlebury silt loam is not so important agriculturally as the high-bottom phase, because the total acreage mapped is less. The typical silt loam occurs in the flats along Tioga, Canisteo, and Chemung Rivers in the southeastern part of the county.

Middlebury silt loam, high-bottom phase.—Middlebury silt loam, high-bottom phase, has a level or flat surface relief and, as the name indicates, occupies a position intermediate between the terraces and first bottoms. In some places it occurs in situations similar to those of the Chenango soils, and as such would be classed as a true terrace, but it lacks the profile development of the Chenango soils.

Surface drainage of this soil is imperfect, and the heavy tight subsoil retards the downward movement of water. These factors limit the agricultural use of the soil to hay and pasture, although on some of the better-drained areas fair yields of silage corn and oats are obtained.

Middlebury silt loam, high-bottom phase, is a rather recent alluvial deposit formed through the normal development of the valleys. Where it occurs in close association with the Chenango soils, the material was deposited in the same manner and is merely an imperfectly drained low terrace.

This soil, although somewhat small in extent, is important agriculturally in the section of the county in which it is developed. It occurs mainly along Cohocton and Chemung Rivers.

Middlebury silty clay loam.—The surface soil of Middlebury silty clay loam, to a depth of 8 or 10 inches, is dark-gray or black silty clay loam high in organic matter. The upper subsoil layer, between depths of 10 and 15 inches, is gray or yellowish-gray compact silty clay loam. The lower subsoil layer is dense and tough gray or bluish-gray clay loam.

This soil has a lower agricultural value than any of the other Middlebury soils. It is too wet for the production of crops and is used exclusively for pasture. It occupies a first-bottom position. Like the other Middlebury soils it is acid in reaction.

Eel silt loam.—Eel silt loam is the best drained member of the Eel series. It has a brown or dark-brown friable silt loam surface soil underlain, to a depth of 24 inches, by yellowish-brown dense silt loam. The lower subsoil layer consists of light-brown silty clay loam highly mottled with yellow and rust brown.

This soil occurs in first-bottom positions in close association with the Chagrin soils, and its cropping characteristics are very similar to those soils. The total acreage of Eel silt loam mapped in the county is small. The soil is practically confined to a small area north of Hornell, and another along Stephens Creek south of Howard.

Eel silt loam, high-bottom phase.—The 8-inch surface soil of the high-bottom phase of Eel silt loam consists of grayish-brown or dark-gray gritty loam or silt loam, which is friable, granular, and

high in organic matter. This material changes abruptly from gritty sandy loam to fine sandy loam which is moderately compact and highly mottled with rust brown and yellow on a gray base. This upper subsoil layer extends to a depth of about 20 inches. Between depths of 20 and 30 inches is gray loamy sand which is compact and tight (becoming very hard when dry), with patches of yellow mottled material unevenly distributed throughout the layer. A variable, though usually small amount, of fine gravel occurs in this layer. The lower subsoil layer, from a depth of 30 inches downward, is gray, mottled with yellow, heavy loam or silt loam, which is dense and tight. Thin lenses of sand and clay occur in some places. The subsoil is everywhere alkaline, and in places the soil is " sweet " from the surface down.

The high-bottom phase of Eel silt loam occurs in a low-terrace position, generally in association with Caneadea soils. Surface drainage is not everywhere good, and open ditches are necessary to remove the excess water.

This soil is not important agriculturally, mainly because it is so small in extent. An area lies south of Wayland, and small areas occur from this point south to Canisteo.

This soil is utilized entirely as hay and pasture land. The Eel soils are intermediate in degree of drainage between the Chagrin and the Wayland soils. They are not so well drained as the Chagrin soils and somewhat better drained than the Wayland soils. The high-bottom phase of Eel silt loam is the most important soil of the Eel series in the county. Like the Wayland soils it is alkaline in reaction.

Eel silt loam, dark-colored phase.—The topsoil of the dark-colored phase of Eel silt loam is 8 inches thick, and it consists of gray, dark-brown, or black friable silt loam which is high in organic matter. The upper subsoil layer is grayish-brown somewhat compact silt loam mottled with yellow and rust brown. The lower subsoil layer is mottled yellow and grayish-brown silty clay loam having a slight content of small gravel.

This soil, in the main, represents a first-bottom condition along some of the small streams, although in places it occurs just at the base of some of the valley slopes. It is imperfectly drained, and in places water sometimes covers the surface. The land is of no great importance agriculturally, as only a small total area is mapped. It is utilized for pasture, hay, and market-garden crops.

Eel clay loam.—Eel clay loam is essentially the same as Eel silt loam, except in the texture of the surface soil which is distinctly heavier. It occupies a topographic position intermediate between the high-bottom phase and the silt loam. It is not important agriculturally because of its very small extent.

POORLY DRAINED VALLEY SOILS

The group of poorly drained valley soils includes soils of the Wayland and Holly series. These soils have dark silty surface soils high in organic matter and underlain by heavier textured highly mottled subsoils. The degree of drainage varies, as evidenced by areas ranging from only a mottled condition, indicating poor drainage, to those which are perennially swampy.

Most of these soils occupy first-bottom positions and represent recent alluvial deposits. They are widely distributed over the county as narrow belts along streams and as depressions that receive seepage water from higher levels.

The total acreage of poorly drained valley soils is not great. Consequently, the soils have little agricultural significance. They are used mostly for pasture. The less wet areas produce fair crops of hay, silage corn, and small grains.

Wayland silt loam.—Wayland silt loam has an 18-inch surface soil consisting of dark-brown or dark grayish-brown, mottled with gray, silt loam or heavy silt loam, which is firm but not compact and shows considerable granulation. A thin transitional zone occurs between depths of 18 and 24 inches, in which the material is brown heavy silt loam slightly mottled with gray and highly granular. The lower subsoil layer, extending from a depth of 24 inches to a depth below 4 feet, is heavy silty clay loam which is tight, tough, and highly mottled. The grayish-blue base color is mottled with rust-brown blotches. Below a depth of 4 feet, the material is heavier in texture and the color is dark brown mottled with gray.

The surface relief of Wayland silt loam is flat or gently undulating, and the soil occupies recent alluvial areas which are subject to overflow during periods of high water.

Wayland silt loam is not extensively developed in Steuben County and consequently does not have very great agricultural importance. The silt loam is the most important Wayland soil, both as regards total area and productiveness. This soil is used almost exclusively as pasture and hay land. Moisture conditions are favorable for the growth of good pasture grasses and clover. Excellent stands of timothy and clover are produced. On the better drained areas silage corn can be grown with moderate success.

The largest and most important area of this soil is in the vicinity of Hornell along Canisteo River. Areas lie along Cohocton River, in which the soil differs from typical Wayland silt loam in having a yellowish-brown surface soil and a lighter textured subsoil. Some areas are gravelly, but as they are too small to separate as a distinct soil they are combined with the silt loam in mapping and are shown by gravel symbols.

Wayland silty clay loam.—Wayland silty clay loam has a gray-brown or dark-gray firm and granular silty clay loam surface soil. The granulation is distinct when the soil is in sod but disappears when the land is brought under cultivation. Puddling and clodding are likely to occur, especially if the soil is worked when wet. The subsoil is gray heavy silty clay loam or clay loam, which is tight, tough, and mottled with rust brown and yellow.

Wayland silty clay loam does not everywhere conform in topographic position with Wayland silt loam, the silty clay loam occurring at higher elevations farther back from the main streams, in positions similar to those occupied by the Holly soils. This soil differs from Holly silty clay loam only in the alkaline character of the subsoil.

Wayland silty clay loam is of very small extent, having been mapped in only a few places, mainly in the Cohocton Valley in the

vicinity of Kanona. This soil is almost exclusively used for pasture, with an occasional field in hay.

Wayland clay loam.—Wayland clay loam is the most poorly drained soil of the Wayland series. It is a permanently wet soil, in many places being under water for the greater part of the year. Consequently it has a low agricultural value. The surface soil is dark-gray or black heavy clay loam high in organic matter. The subsoil is heavy clay loam highly mottled with gray, brown, or yellow, and it is tight and tough. Some small gravelly areas with a lighter textured surface soil are included with this soil in mapping.

The largest and only important areas occur near Cohocton and Atlanta and westward from the latter village to Wayland.

Holly silty clay loam.—The 8- to 10-inch surface soil of Holly silty clay loam consists of gray or dark-gray silty clay loam. The upper subsoil layer is yellowish gray or light gray, highly mottled with rust brown and yellow. The material in this layer is moderately dense and tight. The lower subsoil layer in places is composed of heavy dense sticky blue clay. The surface soil and subsoil are in general free of gravel or stones. The soil material is acid throughout.

Areas of this soil differ considerably in color, texture, and depth of soil material. In some low areas muck or peat may be present. The soil occurs in close association with the Chagrin, Wayland, and Middlebury soils. Most of it occupies first bottoms and is subject to frequent overflow. Natural drainage is poor, and in some places water covers the soil throughout the year. Because of its physical character and poor drainage, this land is best suited for pasture, although a few of the drier areas may be used for hay. This soil occurs in all parts of the county, but its total area is small.

MISCELLANEOUS SOIL MATERIALS

Carlisle muck.—Carlisle muck consists of black completely decomposed organic material to a depth ranging from 4 to 10 feet and in many places is underlain by beds of marl. Only two areas of muck are developed in Steuben County. The largest is north of Hornell along the county line, and the other, which is much smaller, is east of Bath in the east-central part of the county. One area included with Carlisle muck, but somewhat different from the typically developed areas, occurs east of Beans Station in the town of Prattsburg. This particular deposit is composed of a thin layer of black decomposed organic matter overlying brown decomposed fibrous material, resembling peat. The area has not been cleared.

Where Carlisle muck has been drained and brought under cultivation it is utilized entirely for the production of vegetables, principally celery, lettuce, onions, and potatoes.

Carlisle muck, shallow phase.—The shallow phase of Carlisle muck is essentially the same as the deep muck, except that, instead of being from 4 to 10 feet deep, the organic layer is limited to a depth of 24 inches. This shallow muck is underlain by beds of marl or bluish-green calcareous clay. This phase of muck, which is unimportant agriculturally, borders the deeper areas.

Alluvial soils, undifferentiated.—Alluvial soils, undifferentiated, include miscellaneous soils impossible to classify with the other bottom-land soils. They include abandoned stream beds, gravel

wash, and low wet depressions. These soil areas occur both in the valleys and throughout the uplands. They are variable in texture. color, and character of materials. They are not important as a group and are largely nonagricultural.

SOILS AND THEIR INTERPRETATION

Steuben County lies entirely within the gray-brown forest soil region of northeastern United States. The high upland, or plateau, extends northward from Pennsylvania into Steuben County. The soils have developed in the northern part of the belt of gray-brown forest soils where the true podzol profile may be faintly developed.

In a previous section of this report the soils are grouped on the basis of their topographic position, drainage, and reaction. The broad grouping based on the occurrence of the soils in the valleys or in the upland part of the county seems logical, because the materials from which the soils have formed are not entirely the same, nor are the geological processes by which the materials were accumulated similar except in a rather broad sense.

The soils of Steuben County developed under a forest cover are, as a consequence, low in organic matter. The virgin soils had a layer of partly decomposed leaf mold with a few inches of topsoil rather high in organic matter, but when the land was cleared and brought under cultivation this material was rapidly oxidized. The normal, or mature, soil under cultivation has a brown surface soil, but some of the soils, notably those occurring on well-drained terraces, have a darker surface soil, owing to the incorporation of organic matter through the use of manure, green manures, and plant residues.

The amount of organic matter in the soils is related to the degree of drainage, the better-drained soils containing the least and those with imperfect or poor drainage containing the most. However, all the upland soils can be considered as being deficient in organic material, and they are improved in physical condition and tilth by the addition of any plant residues.

The only important agricultural soils having a fair content of organic matter are those developed from the recent alluvial deposits where conditions were favorable for a luxuriant growth of grass.

The region of which Steuoen County is a part was originally covered with vast forests of white pine, maple, birch, beech, oak, ash, hickory, and hemlock. The predominant tree of the forests was white pine, with a hardwood association of maple, beech, and birch ranking second. On the high well-drained ridges and hilltops, stands of oak, or hickory and oak, thrived.

All the original forests have disappeared, the existing forest being composed of second- and third-growth trees. The only evidences of the once great white pine forests are the innumerable stump fences present in the upland parts of the county.

The soils are of rather recent origin, having weathered from the mantle of glacial drift deposited during the last continental glaciation, and as recent soils they still are strongly influenced by the geological character of the parent material.

The degree of glaciation differs in different parts of the county, the upper slopes and the plateau top showing the least effect of the ice.

In these places the mantle of till is rather thin and is composed almost entirely of decomposed material from the local underlying rocks which, over the entire county, were laid down during the Devonian period. These rocks, represented by the Portage group bordering Keuka Lake and the Chemung group over the rest of the county, consist of alternate beds of shales and sandstones and are largely noncalcareous. The rocks underlying the higher areas are predominantly sandstones which are fine grained and dense in character. These rocks have given rise to soils that are not so heavy or plastic as those where shales have contributed the greater part of the soil-forming materials. They are characteristically silty in feel and contain numerous thin fragments of the underlying rock. The sandstone rocks are highly fossiliferous. The calcium, however, has been replaced or leached away. Soils strongly influenced by this rock material are included in the Fremont, Mardin, Lordstown, and Bath series.

The southwestern corner of the county is underlain in part by bright-red shales interbedded with green or bluish-green shales and fine-grained greenish-gray thin-bedded micaceous sandstones. The red shales have given rise to characteristically red or pink soils having silty surface soils and heavier somewhat soapy and greasy subsoils. Soils of the Cattaraugus and Norwich series have been derived from glacial till strongly influenced by these red shales.

In those areas in which shales instead of sandstone are the dominant rocks, the soils are heavier and more highly mottled. The mantle of till is thin and in some places absent, and the present soils have resulted from the weathering in place of the underlying soft shales. Soils of this character include those of the Allis and Hornell series, neither of which is widely distributed.

Soils classed as valley till have weathered from deep deposits of glacial till largely composed of products of the local rocks, with an admixture of crystalline and calcareous materials brought in from the north.

While the morainic deposits were being accumulated in the northwestern part of the county, the streams issuing from the melting ice, the waters of which were loaded with sediments, built up terraces far to the south. A large proportion of these materials was limestone, this having had a strong influence on the present characteristics of the soils. All the valley soils having drainage from the north have calcareous or alkaline subsoils, whereas the soils along streams rising in the south are acid. A striking example of this occurs along Tioga and Cohocton Rivers, the Tioga flowing northward from Pennsylvania and the Cohocton flowing southward and draining the northern part of the county.

The normal, or well-developed soils of Steuben County having developed in a humid forest region are prevailingly light brown or yellowish brown, and they have a rather low content of organic matter. The upper subsoil layers are brown or rust brown, show only a slight degree of compaction, and do not differ greatly in texture from the surface soils. The lower subsoil layers are drab or light gray with a green cast, and they show different degrees of compaction.

The texture is predominantly silt loam with a rather large content of gravel composed of angular fragments of the local sandstone and shale rocks. The well-developed valley soils are lighter in texture, ranging from silt loam to loam, contain rounded and subangular gravel, and have slightly darker surface soils.

The normal soils of the upland and valley sections, in the virgin condition have an imperfect podzol profile, the development of a gray leached layer not being thick enough to influence noticeably the character of the surface soil when brought under cultivation.

The mature, or normal soils have developed only where conditions have been favorable for uninterrupted action of environmental forces. This means that they occur where the surface relief is such that erosion has not continually removed the surface soil and that drainage is sufficiently effective to take care of excess water. Because of local differences in such factors, differences occur in the stage of development of the soils in an area the size of Steuben County.

The factor which has played the most important part in retarding the development of soils in this county is excess moisture. A large proportion of the soils in the upland part of the county have high water tables. These same soils, notably those of the Fremont and Volusia series, have a compact comparatively impervious layer developed from 8 to 15 inches below the surface. This layer is more distinctly developed in the Volusia soils.

Besides excess moisture, erosion, by continual removal of the surface soil, has retarded the normal development of some soils. Soils showing the greatest effects of erosion are included in the Hornell, Dunkirk, and Arkport series.

Soils derived from recent alluvial deposits along streams have been subjected to the forces of weathering for an insufficient length of time to show much profile development.

The soils of the Bath series, where cultivated, are characterized by brown or yellowish-brown surface soils underlain by a highly oxidized rust-brown upper subsoil layer. The lower subsoil layer is drab or light-gray compact slightly mottled till material composed entirely of products from the underlying rocks. The highly oxidized upper subsoil layer makes these soils easily recognized. Throughout the soil are numerous angular fragments of dense fine-grained sandstone. The Bath soils are strongly acid.

Following is a detailed description of a profile of Bath gravelly silt loam as observed 4 miles west of the village of Prattsburg in the town of Prattsburg. The soil as described was observed in a fresh cut through a cultivated field.

0 to 10 inches. Light-brown or rich-brown, when moist, becoming light grayish-brown on drying, light silt loam which is loose, friable, and moderately granular. The granules are small and easily crushed. Scattered over the surface and through the surface soil are numerous small fragments of sandstone.

10 to 15 inches. Rust-yellow light silt loam of the same friable and gravelly character as the surface soil. This layer has no definite structure, breaking out in irregular pieces which are easily crushed. The line of demarcation between this layer and the layer above is distinct, but below it gradually changes to the next lower layer.

15 to 24 inches. Light-yellow very fine sandy loam still friable and open. The angular fragments of sandstone are present in somewhat greater proportion than through the material above.

24 to 36 inches. Yellowish-gray, with a green cast, gritty silt loam which is moderately compact but still allows root penetration. A large quantity of angular stone fragments ranging from 1 to 5 inches in diameter is present. A faint mottling of rust brown and gray is evident in places, more notably in the lower part of the layer.

36 to 48 inches. This layer, consisting of the parent material and showing little evidence of weathering, is drab or greenish-gray hard and compact gritty silt loam or silty clay loam. The material breaks out in irregular lumps which have no definite lines of cleavage. Much force is required to crush the lumps which have a somewhat slick greasy outer surface. The quantity and size of the sandstone fragments seem to increase with depth.

The Bath soils, as a whole, show a greater degree of podzolization than any other soil in the county. One of the striking characteristics of these soils in the northern part of the county is the gray leached layer apparent in road cuts.

A profile description of the virgin soil of Bath gravelly loam under a cover of second-growth beech and maple, 2½ miles southwest of Rexville, is as follows:

0 to ½ inch. An undecomposed surface covering of leaves.

½ to 1 inch. Black decomposed organic matter mixed in an almost solid mat of fine roots.

1 to 7 inches. Purplish-gray sandy loam, loose and open, containing numerous fragments of sugary sandstone.

7 to 12 inches. Rich rust-brown gritty very slightly compact light silt loam. This material breaks out in irregular lumps which are easily crushed.

12 to 22 inches. Light yellowish-brown loamy fine sand showing slight compactness which increases in the lower part of the layer. The material of this layer breaks out in small irregular easily broken lumps.

22 to 30 inches Yellowish-brown or grayish-brown sandy loam or loam which is moderately compact and hard, showing a faint yellow and rust-brown mottled effect. The irregular small cubes, into which the material breaks, have a somewhat vesicular appearance, owing to very small round holes apparently caused by root penetration.

Below 30 inches. This horizon consists of dark-gray or drab compact and hard gritty silt loam or heavy silt loam, containing an appreciable quantity of sandstone fragments which have a coarse sugary texture. This is the parent material and shows little evidence of weathering

Included in the group of well-drained upland soils and associated with the Bath soils are the Lordstown soils which differ from the Bath soils only in the depth at which bedrock occurs. The Lordstown soils are shallow, not exceeding 3 feet in depth.

The steep phase of Lordstown stony silt loam represents more a topographic than a soil condition, and much of the land is nonagricultural. Although steep phases of the Bath soils have been mapped, none of the land is nonagricultural. Typically the Bath soils occur on gently sloping or moderately level areas. In the north-central part of the county, through the towns of Prattsburg, Cohocton, Wheeler, and Avoca, the soils of both series have distinctly brown surface soils and highly oxidized upper subsoil layers, whereas in the southwestern part, where these soils are mapped contiguously, the Lordstown soils lack the rich-brown or rust-brown color of the surface soils of the Bath soils but are gray or grayish yellow.

The characteristic feature of the Cattaraugus soils is their red color. The materials from which these soils have weathered were derived in part from the underlying red shales of the region. The

Cattaraugus soils are coextensive with the outcrops of these red shales which occur only in the southwestern corner of the county. The soils of this series have red, brown, or pink friable surface soils with heavier, and in places mottled, subsoils. The substratum consists of heavy soapy red or purplish-red unweathered till or shales and sandstones. Stones of a somewhat massive character are scattered over the surface in places.

Following is a detailed profile description of Cattaraugus gravelly loam as observed in a fresh road cut under a cover of second-growth beech, maple, and hemlock, 1½ miles west of West Union Church in the town of West Union.

0 to 1½ inches. Brown partly decomposed litter, the lower part of which is a solid mass of fine roots.

1½ to 4 inches. A layer of black granular decomposed organic matter, in which the granules average one-eighth inch in diameter. This layer contains many fine roots and has been considerably worked over by worms.

4 to 9 inches. Purple at the top, grading to gray in the lower part, gravelly sandy loam, friable and loose in the upper part of the layer but somewhat compact in the lower part. This highly leached layer is somewhat variable in thickness, in places being only faintly developed or absent.

9 to 10 inches. Very dark brown or coffee-brown soft and friable smooth silt loam.

10 to 16 inches. Reddish-brown or intense rust-brown gritty silt loam containing a small quantity of gravel and a few small fragments of sandstone.

16 to 22 inches. Purplish-brown gritty silt loam which is moderately compact and hard. The material breaks out in small irregular lumps which, under pressure, are reduced to a coarsely granular mass. Like the layer above, this layer also contains gravel, the individual fragments attaining a diameter of 1 inch. They are subangular in shape and are composed of coarse sandstone.

22 to 48 inches. Dark-red hard and compact heavy silt loam or silty clay loam, containing considerable grit and a few angular sandstone fragments. The material breaks out in large irregular lumps which, with considerable force, can be reduced to small cubes. The outer surfaces of the cubes have a thin coating of red soapy appearing clay. The freshly broken surfaces of these structural aggregates have a more intense red color.

Below 48 inches. The substratum, a grayish-purple hard compact silty clay loam, with the underlying rocks in places approaching within 4 feet of the surface.

The poorly drained upland soils, which include the Fremont and Volusia soils, differ from the normally developed soils in having grayer and heavier-textured surface soils and heavier, more compact, and more highly mottled subsoils. The compaction in the subsoil of the Volusia soils approaches cementation. Both the Fremont and Volusia soils are known as hardpan soils. Characteristically, the Fremont soils occur on the plateau summits, but the Volusia soils are typically developed on long moderately steep or gentle slopes where they receive seepage water from the higher areas.

The soils of both the Hornell and Allis series are shallow. The Allis soils differ from the Volusia soils in depth and in the character of the parent material. The Hornell soils range from 18 to 36 inches in depth and rest on soft dark shales. They are extremely heavy in texture and are highly mottled in the lower part of the profile.

Permanently wet soils are saturated for a greater part of the year and in places represent a swamp condition. They occupy the low areas and depressions within areas of the poorly drained soils, and, aside from the degree of drainage and darker surface soil, resemble these soils rather closely.

Valley-till soils, which include the Wooster and Lansing soils, resemble closely the normal soils of the county. The Wooster soils have rich-brown surface soils and highly oxidized subsoils, similar to corresponding layers of the Bath soils, but unlike the Bath soils they have loose noncompact lower subsoil layers, and the deposits of glacial till from which they have weathered are deeper and contain a greater assortment of materials, much of which is water-worn. The Bath and Wooster soils, where mapped together, closely resemble each other. The Bath soils, however, are typically developed on the plateau top and summits of the hills, whereas the Wooster soils occupy the lower slopes and valleys. The Lansing soils occur only in the section adjacent to Keuka Lake. They have gray rather than brown surface soils and grayish-brown slightly mottled and moderately compact subsoils. The parent material contains a rather large quantity of shale and in places has the appearance of having been reworked with a considerable amount of lacustrine material.

The Mardin soils represent a widely distributed group of imperfectly drained upland soils. As most of this land has been cleared, few areas having the podzol surface soil remain, but in places the true podzol development occurs. They have gray or gray-brown surface materials which are moderately friable and contain rather large quantities of angular and subangular shale and sandstone fragments not only scattered over the surface but throughout the soil. The upper part of the subsoil is yellowish brown, only slightly compact, and is mottled yellow and gray in the lower part of the layer. The lower subsoil layer is hard, compact, and mottled, which has caused these soils to be classed locally as hardpan soils. However, no real induration occurs, but the consistence of the subsoil material is such as to noticeably impede the movement of water.

A profile of the virgin soil of Mardin gravelly silt loam as observed under a cover of second-growth beech and maple, 4 miles northwest of Wheeler, in the town of Wheeler, is as follows:

0 to 1¼ inches. A very thin layer of slightly decomposed leaves. This material is brown and has been considerably worked over by worms.

1¼ to 6 inches. Very dark grayish-brown silt loam containing much fine gravel and grit. The material is distinctly granular, with the structural particles ranging in diameter from one-sixteenth to one-fourth inch. Many of the granules are composed of worm casts. The material in this layer is tightly bound toge her with fine roots.

6 to 12 inches. Yellowish-brown friable gritty s'lt loam showing slight granulation. Streaks of gray granular material pierce this layer at irregular intervals. Much root development has taken place.

12 to 18 inches. Pale yellowish-brown gravelly silt loam, the gravel consisting of numerous small thin fragments of sandstone. Although friable in the upper part of the layer, moderatė compaction is apparent at a depth of about 15 'nches. The material has no distinct structure but breaks out in irregular lumps which are somewhat vesicular. This layer is mottled with rust brown and yellow, faint in the upper part but more pronounced at a depth of 18 inches. Roots are well developed in this layer, but they do not penetrate far below a depth of 18 or 20 inches.

18 to 26 inches. Light yellowish-gray silt loam having a green cast, mottled with yellowish brown and gray. The material is compact and moderately hard and becomes more so with increasing depth. The proportion of angular sandstone fragments is greater in this layer than in the layers above. The material has no distinct structure, except the irregular lumps into which it breaks. Aside from a few large roots penetrating beyond this depth, roots are absent.

26 to 40 inches. Greenish-gray or drab gritty silt loam which is very compact and hard in place, but when broken out the irregular lumps crush with moderate force. Numerous angular sandstone and shale fragments, ranging from 1 to 6 inches in diameter, are scattered through this layer. Little difference exists between the material in this layer and that below a depth of 40 inches, except that compaction may be somewhat greater.

Besides the Mardin soils, the Langford soils also are imperfectly drained. Their color and structural profiles resemble closely those of the Mardin soils. They differ, however, in the alkaline character of the subsoil and in the composition of the parent material which in the Langford soils contains more foreign materials, less sandstone, and more shale.

The Howard soils are characterized by a strongly developed calcareous subsoil. The materials from which these soils have developed represent deposits accumulated as stream terraces or deltas built up in temporary glacial lakes through the action of water. The sands and gravels with which these land forms were built up are composed of limestone and crystalline materials brought in from the north, in addition to local shales and sandstones. These soils have been subjected to the forces of weathering for sufficient time to have the calcareous material leached to a depth ranging from 2 to 3 feet. Below this depth a large proportion of the sand and gravel is composed of limestone.

Following is a detailed description of the profile of Howard gravelly silt loam as observed in an exposure one-half mile east of Howard:

0 to 8 inches. Brown (when moist) or grayish-brown (when dry) gravelly silt loam which is friable and mellow under cultivation but somewhat compact and hard when in sod. It contains only a moderate amount of gravel.

8 to 16 inches. Yellow or yellowish-brown silt loam, distinctly heavier in texture than the surface soil. The material in this layer is moderately compact in place, but it is friable when broken out. It is almost free of gravel.

16 to 24 inches. Reddish-brown or yellowish-brown gravelly silt loam containing a greater proportion of gravel than the layers above. The gravel is covered with, and somewhat bound together by, an infiltration of fine material. This is a transitional zone between the layers above and below.

24 to 36 inches. Reddish-brown gravel and sand with the interstitial spaces filled with fine material, giving the soil a rather plastic consistence when moist. The material, which is moderately hard and compact, breaks out in irregular lumps. The individual pebbles and cobbles are covered with a thin reddish-brown film of silt or clay. The depth of this layer is variable, and tongues of the material may penetrate to a depth of 4 feet.

Below 36 inches. Mixed unweathered sand and gravel, becoming stratified at a depth ranging from 5 to 8 feet. Approximately 50 percent of the gravel is composed of limestone.

In addition to the Howard soils, the well-drained valley soils include the Chenango, Groton, Otisville, and Dunkirk soils. The only

difference between the Howard and Chenango soils is the depth at which limestone gravel is reached. In the Howard soils, gravel occurs at a depth ranging from 24 to 36 inches from the surface, but in the Chenango soils gravel is present in few places above a depth of 4½ feet. The Groton and Otisville soils are derived from stratified morainic deposits with a kame and kettle surface relief. In the Groton soils limestone is reached at a depth ranging from 18 inches to 3 feet and in the Otisville soils at a depth ranging from 6 to 10 feet. These soils are similar to the normal well-developed soil in all other important respects. The Dunkirk soils, because of the character of the parent material, which is composed of lake-laid clays, do not weather so rapidly and consequently do not show so much profile development as the other soils of this group. They have the brown or grayish-brown surface soil and the heavier slightly compact reddish-brown upper subsoil layer characteristic of the other soils of the group, but not so well developed. The calcium has been leached from the upper 2 or 3 feet of material. The more rolling areas of these soils have been severely eroded.

CLASSIFICATION OF LAND ACCORDING TO NATURAL PRODUCTIVITY

Table 5 gives a classification of the land, according to its natural productivity, for each of the important crops grown in Steuben County.

This classification compares the productivity of each of the different kinds of land in the county for a given crop, to a standard, namely, the most productive land in the United States for that crop. The rating of productivity of a given kind of land for a given crop is called its productivity index for that crop. The most productive land in the United States for a given crop is given a productivity index of 10 for that crop, which is called the base index and is the standard with which the productivity of all other land for that crop is compared. Therefore, land estimated to be about half as productive for that crop as the best in the United States receives an index of 5. In addition to productivity indexes for each important crop, each kind of land is assigned a general productivity rating or grading of agricultural quality. The kind of land having the highest average productivity indexes in each of the great agricultural regions is given the rating or grade of 1 for that region, the kind having the next highest the grade of 2, and so on.

In the determination of this general productivity grade, more weight is given to productivity of the important staple crops than of minor crops.

Obviously, the natural productive capacity of land means the productivity without the repeated use of amendments. Yields obtained through the use of amendments do not well indicate the natural productivity of the land. However, some kinds of land, although low in inherent productivity, are responsive to the application of amendments and produce good yields or high quality of product. Because the index of inherent or natural productivity does not express the responsiveness of land to fertilizer, a second index is used (in parentheses) to compare the productive capacity of a given kind of land under the amendment practices most commonly used in the section

TABLE 5.—*Classification of land in Steuben County, N.Y., according to its na*

Soil type	Productivity rating [1]	Acres	Crop productivit						
			Corn (grain)	Corn (silage)	Wheat	Oats	Buck-wheat	Timo-thy and alsike	Red clover
	Grade no.								
Chagrin silt loam, high-bottom phase Tioga silt loam, high-bottom phase	1	3,648	4	9	7	8	5	9	8
Dunkirk silt loam	2	1,920	3 (6)	6 (8)	5 (7)	7 (8)	7	7	6 (8)
Chenango silt loam	2	2,176	4 (6)	7 (9)	6 (8)	7 (9)	5	7	6 (8)
Wooster silt loam, calcareous phase	2	4,096	3 (6)	6 (8)	5 (7)	6 (8)	6	7	6
Wooster gravelly silt loam Wooster gravelly loam	3	47,488	2 (4)	6 (8)	5 (7)	6 (8)	7	5	4 (6)
Howard fine sandy loam Howard gravelly silt loam Howard gravelly loam	3	12,160	3 (5)	6 (8)	4 (6)	5 (7)	4	4	5
Chenango fine sandy loam Chenango loam Chenango gravelly silt loam Chenango gravelly loam Chenango gravelly sandy loam Chenango very fine sandy loam	4	40,704	3 (5)	6 (8)	3 (5)	3 (5)	3	3	4 (6)
Lansing gravelly silt loam	4 [5]	4,800	2 (4)	4 (6)	4 (6)	5 (7)	6	6	6
Arkport gravelly loam Arkport fine sandy loam	4	5,312	3 (5)	6 (8)	3 (5)	3 (5)	3	3	5
Bath gravelly silt loam	4	24,704	1	3 (6)	4 (6)	5 (7)	7	5	4 (6)
Cattaraugus silt loam Cattaraugus gravelly loam	4	21,568	------	3 (5)	4 (6)	5 (7)	7	5	4 (6)
Bath silt loam Mardin gravelly silt loam Mardin gravelly silt loam, deep phase Langford silt loam	4	184,384	1	3 (6)	4 (6)	5 (7)	7	5	4 (6)
Angola gravelly silt loam Bath gravelly loam Lordstown gravelly silt loam Lordstown stony silt loam	5	139,840	1	3 (6)	2 (4)	4 (6)	4	3	2 (4)

[1] Land having the highest general agricultural productivity in the agricultural region in which it occurs is rated grade 1 for th column 2 the upper figure refers to the grade number when drained or protected from flood, and the lower figure refers to the grad

[2] Land most productive for the specified crop in the United States=10. Figures in parentheses indicate the productivity of soil amendments, as lime, fertilizer, and manure

[3] Vegetables doing best on highly organic soils, e g., onions, celery, lettuce.

[4] Vegetables not requiring highly organic soils, also small fruits.

[5] Moderately hilly or stony land, not very erosive, but not well adapted to farm machinery.

TABLE 5.—*Classification of land in Steuben County, N.Y., according to its natural*

Soil type	Productivity rating	Acres	Crop productiv						
			Corn (grain)	Corn (silage)	Wheat	Oats	Buck-wheat	Timo-thy and alsike	Red clover
	Grade no.								
Groton gravelly loam Groton fine sandy loam Otisville gravelly loam	6 [5]	14,976	2 (4)	2 (4)	2 (4)	2 (4)	2	2	2
Wooster stony silt loam Bath gravelly silt loam, stony phase	6 [5]	17,216	1 (2)	3 (6)	2 (4)	3 (5)	4	4	3 (5)
Wooster gravelly silt loam, steep phase Wooster gravelly loam, steep phase Arkport fine sandy loam, steep phase Dunkirk silt loam, rolling phase Bath stony silt loam, steep phase Bath gravelly loam, steep phase Cattaraugus gravelly loam, steep phase Mardin gravelly silt loam, steep phase Mardin stony silt loam, steep phase Wooster stony silt loam, steep phase Langford silt loam, steep phase	8 [6]	21,312	-------	1	1	1	1	2	1
Allis gravelly silt loam Allis silty clay loam Hornell silty clay loam	8	10,626	-------	1	-------	2	2	2	-------
Lordstown stony silt loam, steep phase Allis gravelly silt loam, steep phase Hornell silty clay loam, steep phase	9 [6]	89,856	-------	-------	-------	-------	1	1	-------
Tioga fine sandy loam Tioga silt loam Chagrin silt loam Chagrin silt loam, dark-colored phase	1 [7] 2 [8]	18,816	4 4	9 9	7 3	8 8	5 5	10 10	8 6
Chagrin loam	1 [7] 2 [8]	1,600	4 2	9 4	7 2	8 4	5 3	10 7	8 4
Eel clay loam Eel silt loam Eel silt loam, high-bottom phase Wayland silt loam	1, drained 4, undrained [8]	4,544	4 2	9 3	6 1	8 4	6 5	10 9	8 3
Eel silt loam, dark-colored phase	1, drained [7] 8, undrained [8]	1,152	4	9	6	8	6 2	10 6	8
Caneadea silt loam	2, drained 4, undrained	1,792	3 (6) 2	6 (8) 4	5 (7) 3	7 (8) 6	7 6	7 7	6 (8) 4

Middlebury silt loam	2, drained	3,904	4	8	5	8	7	10	6
Middlebury silt loam, high-bottom phase	5, undrained		2	3	1	4	5	9	3
Caneadea silty clay loam	2, drained	1,472	3 (5)	6 (8)	5 (7)	7 (8)	7	7	6
	5, undrained		1	3	2	5	5	6	3
Holly silty clay loam									
Wayland silty clay loam	2, drained [7]	9,728	3	7	5	7	8	9	6
Wayland clay loam	8, undrained [8]		----	1	----	1	3	5	----
Middlebury silty clay loam									
Fremont gravelly silt loam									
Fremont silt loam	4, drained	102,720	2 (4)	3 (6)	3 (6)	4 (6)	6	5	5
Erie gravelly silt loam	6, undrained		1	2 (4)	1	3 (5)	6	5	2
Carlisle muck	5, drained	3,456	([9])	----	----	----	----	----	----
Carlisle muck, shallow phase	9, undrained		----	----	----	----	----	1	----
Volusia silt loam									
Volusia gravelly silt loam									
Volusia silt loam, dark-colored phase	6, drained	79,984	1 (2)	3 (6)	2 (4)	3 (5)	5	4	----
Volusia silt loam, shallow phase	7, undrained		----	2 (4)	1	2 (4)	4	4	----
Volusia gravelly silt loam, stony phase									
Fremont gravelly silt loam, stony phase									
Norwich gravelly silty clay loam	8, undrained [9]	19,136	([9])	----	----	----	----	----	----
Chippewa gravelly silty clay loam			----	----	----	----	----	1	----
Alluvial soils, undifferentiated	8, undrained [9]	5,632	([9])	----	----	----	----	1	1

[5] Moderately hilly or stony land, not very erosive, but not well adapted to farm machinery
[6] Steep or stony land, on which tillage is extremely difficult.
[7] Land with optimum protection from overflow.
[8] Land with no protection from overflow.
[9] Indexes omitted because of uncertainty of natural productivity of crops not now grown

NOTE.—In the case of items such as tree fruits, vegetables, and vegetables and small fruits, which include a group of ass land for that member of the group best adapted to the land in question. Thus, land well adapted to apples may be expected to bility to peaches or other fruits may be poor.

where it occurs with the productive capacity of the naturally most productive land under the common amendment practices of its section. It compares what may be expected in the way of yield and quality of product from different kinds of land under cultural practices. Quality of product average being equal, it would be approximately the same as a comparison of average yield of product. This index is used only where amendments are added to the land as a common practice. The factors influencing the productivity of land are mainly those of climate, soil, and surface configuration. All are considered in the determination of the productivity indexes, and a low index for a particular crop may as likely be due to an unfavorable climate or surface configuration as to fertility of soil. Surface configuration is important mainly on account of its influence on erosion. It is of course also a secondary factor that helps to determine the character of both climate and soil. Surface configuration in its effect on the use of agricultural machinery does not affect the productivity index. Erosiveness does affect the productivity index. Climatic and soil conditions that are a result of surface configuration are considered as climatic and soil factors. Difficulty of tillage due to surface configuration is indicated by references opposite the grade number.

In the case of land with poor natural drainage, two series of indexes are given, one applying to land with no artificial drainage, the other to land to which optimum artificial drainage has been applied. In many instances some artificial drainage, but not the optimum, has been applied to poorly drained lands so that their inherent productivity under optimum drainage is not realized.

In the case of bottom land subject to periodic overflow, two sets of indexes are given, one applying to the land when it receives optimum protection from overflow, the other to the land with no such protection. This double series of indexes is used to indicate the inherent or potential productivity of poorly drained or overflow lands.

The cost or difficulty of effecting drainage or protection from overflow plays no part in the productivity rating of such lands. Two kinds of land having the same productivity when drained are rated the same, although optimum artificial drainage may cost 10 times as much on one as on the other.

Productivity indexes for the staple crops were not assigned to Carlisle muck when drained, because of the uncertainty as to the productivity of organic soils used without fertilizer. Most organic soils require not only drainage but fertilization to supply deficiencies of mineral plant food, characteristic of most organic soils. In some instances muck or peat have had considerable quantities of mineral matter washed from adjoining soils and are, to the extent that this mixture has taken place, less deficient in mineral plant foods. Indexes were not assigned to alluvial soils, undifferentiated, when drained and protected from overflow because of the very mixed character of the material and the slight likelihood of reclamation. They were not assigned to drained Norwich gravelly silty clay loam and Chippewa gravelly silty clay loam because of the slight likelihood of their being drained and the indeterminate effect of drainage on their productivity.

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LEGEND

- Allis gravelly silt loam — As
- Allis silty clay loam — Ac
- Bath gravelly loam — Bl
- Bath stony silt loam, Steep phase — Bs
- Bath gravelly silt loam — Bg; Stony phase — Bg
- Bath silt loam — Bm
- Caneadea silt loam — Ca
- Caneadea silty clay loam — Cc
- Cattaraugus gravelly loam — Cy
- Chagrin loam — C
- Chagrin silt loam — Cn; High-bottom phase — Cn
- Chenango gravelly sandy loam — Ch
- Chenango fine sandy loam — Cf
- Chenango gravelly loam — Cg
- Chenango loam — Co
- Chenango gravelly silt loam — Cl
- Chenango silt loam — Ct
- Dunkirk silt loam — Dm; Rolling phase — Dm
- Chippewa gravelly silty clay loam — Cp
- Eel silt loam, Dark-colored phase — El
- Erie gravelly silt loam — Es
- Fremont gravelly silt loam — Fg; Stony phase — Fg
- Fremont silt loam — Fl
- Groton fine sandy loam — Gf
- Groton gravelly loam — Gg
- Holly silty clay loam — Hs
- Hornell silty clay loam — Hl
- Howard gravelly loam — Hg
- Howard gravelly silt loam — Ho
- Langford silt loam — Lm
- Lansing gravelly silt loam — Lg
- Lordstown stony silt loam — Ll; Steep phase — Ll
- Lordstown gravelly silt loam — Lo
- Mardin stony silt loam, Steep phase — Ms
- Mardin gravelly silt loam — Mg; Steep phase — Mg
- Middlebury silty clay loam — Mc
- Alluvial soils (*Undifferentiated*) — A
- Middlebury silt loam — Ml; High-bottom phase — Ml
- Norwich gravelly silty clay loam — Ng
- Otisville gravelly loam — Og
- Tioga fine sandy loam — Tf
- Tioga silt loam — Ts; High-bottom phase — Ts
- Volusia gravelly silt loam — Vg; Stony phase — Vg
- Volusia silt loam — Vs; Dark-colored phase — Vs; Shallow phase — Vs
- Wayland silt loam — Wm
- Wayland clay loam — Wc
- Wayland silty clay loam — Wy
- Wooster gravelly loam — Wo
- Wooster stony silt loam — Wl
- Wooster gravelly silt loam — W; Steep phase — W
- Wooster silt loam, calcareous phase — Ws
- Carlisle muck — Cm

W. J. Latimer, Acting Inspector, District 1.
Soils surveyed by C. S. Pearson, in charge, and F. B. Howe and D. F. Kinsman, Cornell University Agricultural Experiment Station, and Robert Wildermuth, R. C. Roberts and A. H. Hasty, U. S. Department of Agriculture.

Scale $\frac{1}{62500}$
1 ½ 0 1 2 3 4 Miles
1 ½ 0 1 2 3 4 5 Kilometers
Contour interval 20 feet.
Datum is mean sea level.

BASE MAP FROM
U. S. GEOLOGICAL SURVEY SHEETS

WILLIAMS & HEINTZ CO. WASH. D.C.

Field Operations
Bureau of Chemistry and Soils
1931

U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP

STEUBEN COUNTY—WESTERN SHEET
NEW YORK

CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION
C. E. LADD, DIRECTOR
T. L. LYON, HEAD, DEPARTMENT OF AGRONOMY

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